DRAFT DRAFT

EXHIBIT A

ENVIRONMENTAL CONVERSATION AND
CHEMICAL COPRORATION (ECC) SITE
ZIONSVILLE, INDIANA

MARCH, 1989

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ECC SETTLING DEFENDANTS

PREPARED BY:

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PROJECT NO.: 8076

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EXHIBIT A

1.0 INTRODUCTION

This document is a Remedial Action Plan (hereafter, "Remedial Action Plan") "Exhibit A" or the "Document" and describes the work to be performed at the Environmental Conservation and Chemical Corporation ("ECC") Superfund site as required by the 1989 ECC Consent Decree ("Consent Decree" or "Decree"). This document is attached as Exhibit A to, and is incorporated by reference into and made an enforceable part of, that Decree.

The purpose of this Exhibit A is to set forth those remedial activities to be performed at the ECC site necessary to achieve a health-based cleanup so that the site will not, once the work is performed, cause or present any risk to human health or the environment. The settling defendants under the Consent Decree ("Settling Defendants") shall arrange to have the work required hereunder performed by a Contractor or Contractors ("Contractor") in accordance with the requirements and specifications set forth herein.

2.0 REMEDIAL ACTION PLAN

This Remedial Action Plan (RAP) addresses, in a technically feasible and cost-effective manner, all environmental concerns regarding the ECC site, namely:

- o Direct contact with soils containing volatile organics (VOCs), base neutral/acid organics, and heavy metals;

- Contamination of ground water by precipitation percolating through soils containing VOCs, base neutral/acid organics, and heavy metals;

- Contamination of surface waters by overland migration of water in contact with soils containing VOCs, base neutral/acid organics, and heavy metals;

- Ingestion of ground water containing VOCs, base neutral/acid organics, and heavy metals; and

- Contamination of surface waters by discharge of ground water containing VOCs, base neutral/acid organics and heavy metals.

Additionally, the RAP complies with the Superfund Amendments and Reauthorization Act (SARA) of 1986 by treating the contaminants at ECC so that they do not present any current or currently foreseeable future risk to health or the environment.

The RAP, which is described in detail in the following sections, includes the components listed below:

- Soil vapor extraction, concentration, and destruction;

- Installation of a RCRA-compliant cover;

- Establishment of access restrictions; and

- Ground water and surface water monitoring.

The intent of this RAP is to provide for the implementation of a comprehensive remedy that will remediate the site and will constitute "clean closure" by removing and destroying wastes at the site so as to preclude any risk to human health and the environment through any media (air, soil, surface water, or ground water). The soil vapor extraction system to be implemented under this Document will result in a cleanup level for constituents of concern in the site soils so as to obviate the need for ground water interception/collection systems at the site. Specifically, the soil vapor extraction system has been designed and will be operated to achieve Cleanup Standards (as specified in Table 3-1 below) in the soil as well as in the ground and surface water at the site that will protect human health and the environment.

Design of the vapor extraction system in the area beneath the concrete slab and placement of the RCRA-compliant cover over the site in advance of the vapor extraction process will prevent the infiltration of water beneath the concrete slab and migration through the subbase of the concrete slab.

Surface water and ground water sampling will be conducted during and after the operation of the vapor extraction system to verify the effectiveness of the RAP.

The components of the RAP as presented herein are compatible with the proposed remedy for the adjacent Northside Sanitary Landfill (NSL) site. As the remedial design is finalized for the NSL site, the respective RAPs for ECC and NSL will be reviewed to ensure compatibility of design and construction schedules for each system.

2.1 Elements of the RAP

2.1.1 Soil Vapor Extraction, Concentration and Destruction

The objective of the soil vapor extraction activity is to remove and destroy existing VOCs from the soils (as provided herein) and thereby:

- o prevent contact with contaminated soils;

- o prevent migration of contaminants from the soils to the surface water and ground water; and

- o prevent migration of contaminants from the ground water to the surface water.

Enhanced soil vapor extraction has been selected as the technology for removing the existing VOCs and certain base neutral/acid organics of potential concern from the soils at the ECC site. By systematically and uniformly moving air through the zone of contamination, volatilization and hence removal of organics are accelerated. For the ECC site, air movement through the soil will be controlled by a network of vertical trenches installed throughout the zone of contamination. The process also involves the continuous extraction of organics-laden air from the trench system and treatment of the air by activated carbon to remove the organics. The organics so collected will then be destroyed off-site in conformance with applicable federal and state requirements.

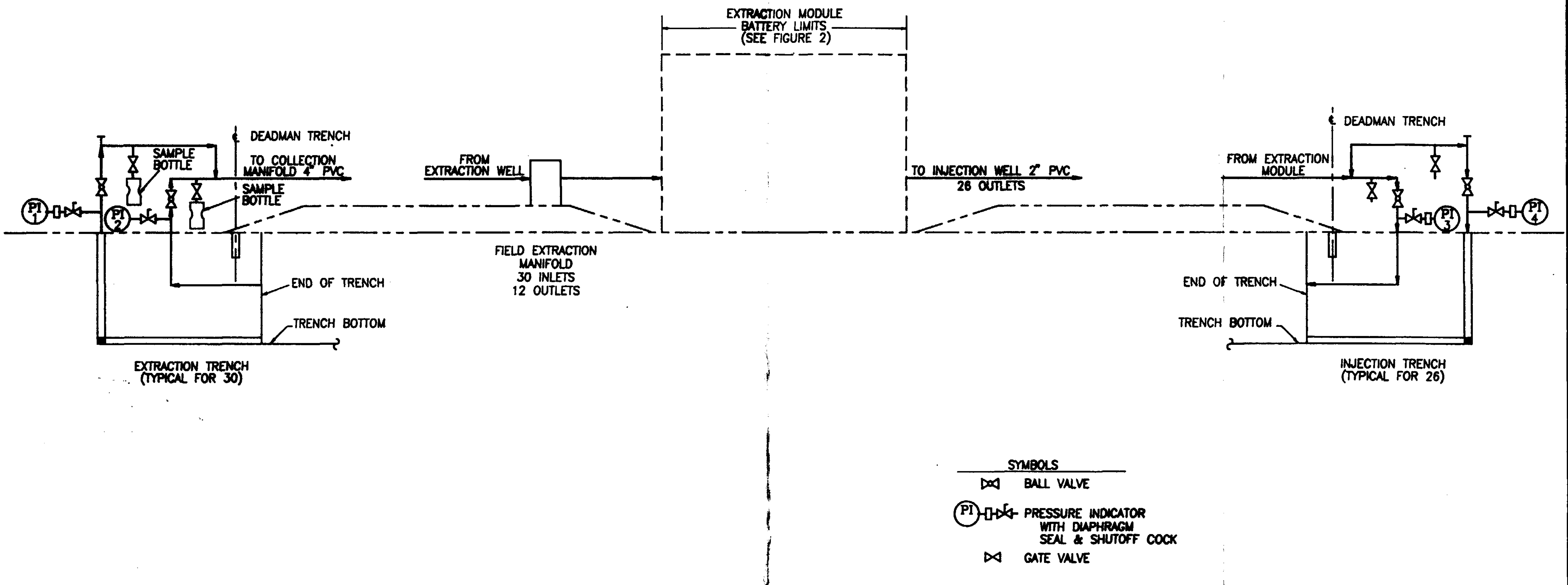
The effectiveness of vapor extraction for organics removal from the ECC soils was demonstrated during a pilot test conducted by Terra Vac in June, 1988. The description of the pilot test, including the results obtained, was previously submitted to USEPA and the State of Indiana, and is specifically incorporated by reference herein and made a part hereof. The test showed an initial high organics extraction rate of 1.9 pounds per day per foot of trench that decreased over the course of the pilot test to a steady state rate of approximately 0.25 pounds per day per foot of trench. Although the Terra Vac pilot study provides the foundation for the system designed herein for ECC, during the conceptual and preliminary engineering phase, several engineering and operational enhancements were developed which will improve overall performance and effectiveness of the vacuum extraction system to be implemented under this RAP. These system enhancements are the result of consultations among ERM-North Central, Inc., Midwest Water Resource, Inc. (MWRI), and Terra Vac, Inc. A summary of the key improvements are:

- o Virtual elimination of surface water infiltration within the zone of contamination;

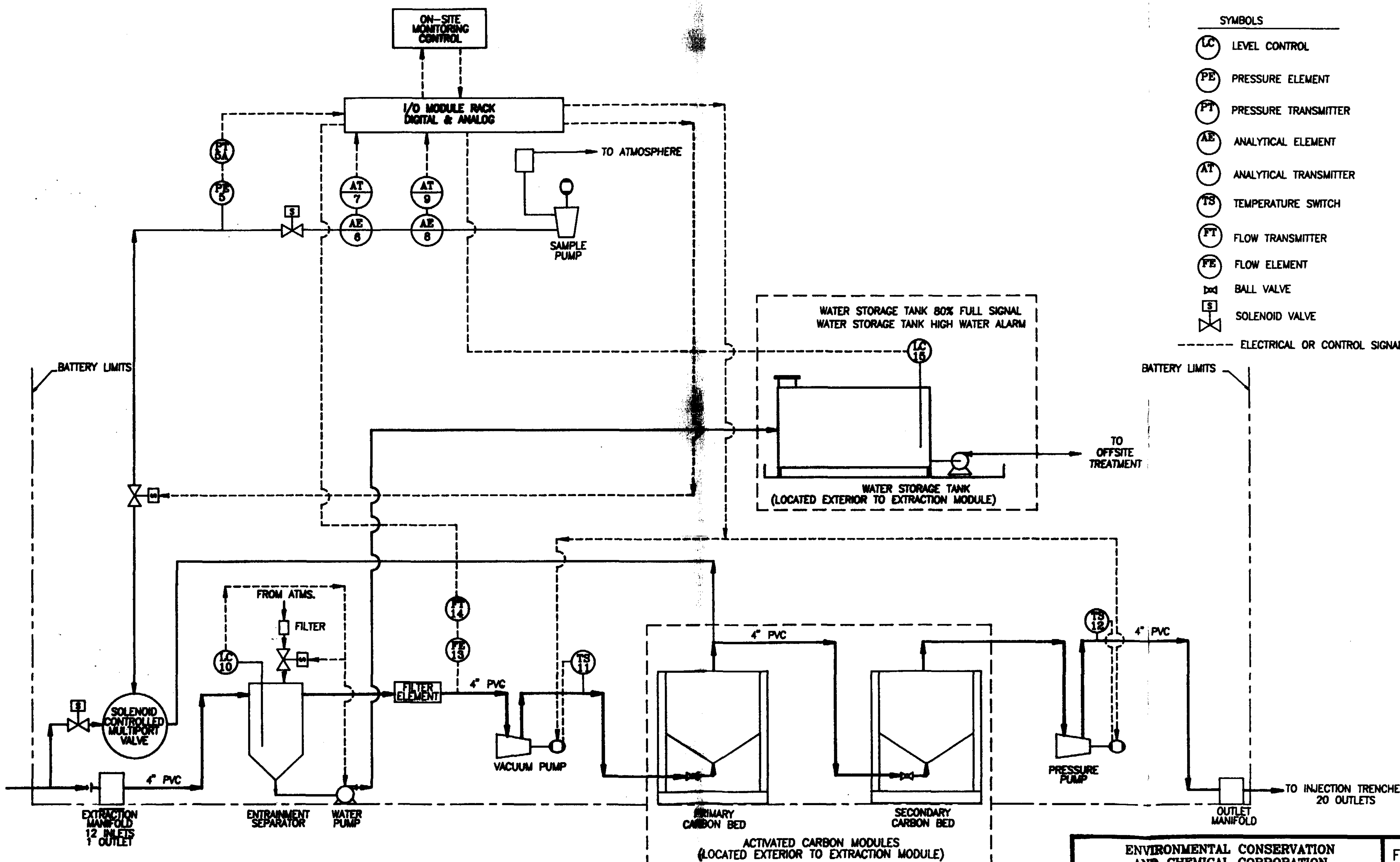
- Substantial reduction in the volume of air required for effective remediation;
- Virtual elimination of atmospheric discharges of treated extraction air;
- Positive control (collection and removal) of any till moisture encountered in the zone of treatment; and
- Uniform and essentially horizontal movement of air through the zone of contamination resulting in optimal air/organics contact during operation.

The following discussion and drawings clearly illustrate the design and operation details of the soil vapor extraction system.

The soil vapor extraction process is illustrated in Figures 2-1 and 2-2. The basic operation consists of extraction of air using a single vacuum pump from a network of 30 extraction trenches located throughout the site. Free liquid entrained in the air is removed by gravity in an entrainment separator. Periodically, water which accumulates in the entrainment separator is pumped to an on-site storage tank for subsequent transport to an off-site facility for treatment as necessary. From the vacuum pump, air passes through the carbon adsorption system, which consists of two upflow carbon columns connected in series. Off-gasses from the carbon adsorption system are withdrawn by a pump which boosts the pressure and reinjects air into a network of 26 injection trenches located throughout the site. Each injection trench is



ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION ZIONSVILLE, INDIANA PROCESS FLOW AND INSTRUMENT DIAGRAM	FIGURE NO. 2–1
ERM ERM–North Central, Inc.	2/28/89 mo



ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION
ZIONSVILLE, INDIANA
PROCESS FLOW DIAGRAM-EXTRACTION MODULE

FIGURE NO. 2-2

ERM ERM-North Central, Inc.

2/28/89

mo

located between and parallel to a pair of extraction trenches. The injected air then migrates from the injection trench through the soil towards the extraction trench. As the air migrates through the soil towards the extraction trench, the organics are vaporized into the air stream. A RCRA-compliant cover will be placed over the entire trench network to prevent air and water infiltration into the system during operation.

The major system components are:

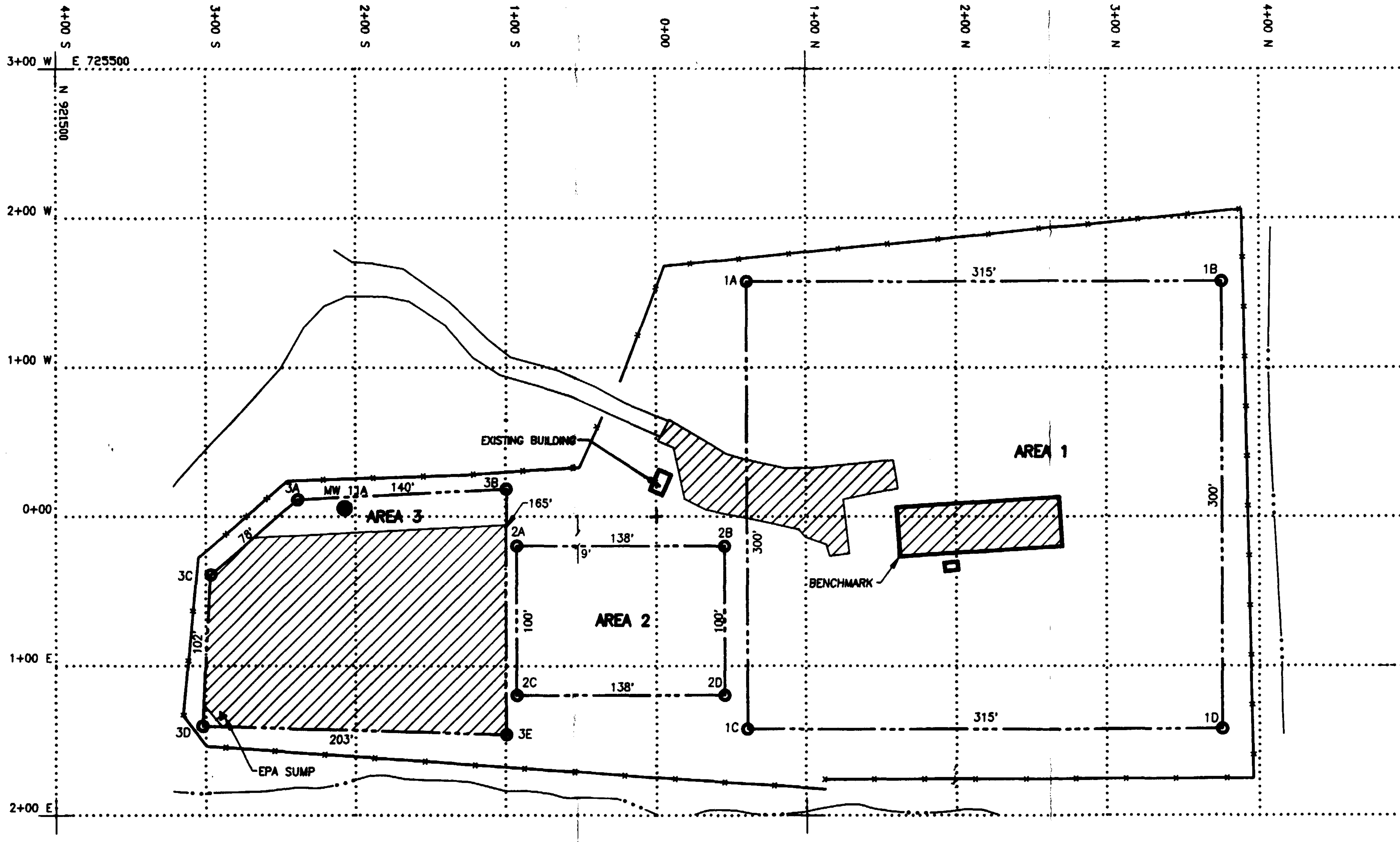
- Extraction and injection trenches;
- Soil vapor extraction system;
- Water collection system;
- Carbon adsorption system;
- Air injection system; and
- RCRA-compliant cover.

A description of the design and operational features of each of these components is presented below.

Extraction and Injection Trenches

The area where remedial activity will occur is depicted in Figure 2-3. The layout and construction details for the network of 30 extraction trenches and 26 injection trenches are presented in Figures 2-4 and 2-5. Trench spacing varies between 17 and 18 feet, and trench length varies depending on the configuration of

LOCATION COORDINATES		
POINT	N/S	E/W
1A	0+60 N	1+58 W
1B	3+76 N	1+58 W
1C	0+60 N	1+42 E
1D	3+76 N	1+42 E
2A	0+92 S	0+20 E
2B	0+45 N	0+20 E
2C	0+92 S	1+20 E
2D	0+45 N	1+20 E
3A	2+38 S	0+11 W
3B	1+00 S	0+18 W
3C	2+98 S	0+39 E
3D	3+03 S	1+40 E
3E	1+00 S	1+46 E
MW 11A	2+08 S	0+06 W
EPA SUMP	2+86 S	1+34 E
BENCHMARK	1+62 N	0+27 E



APPROX. SCALE (ft)

0 25 50 100

LEGEND:

- FENCE LINE
- BUILDING LINE
- PAVEMENT EDGES
- BOUNDARY LINES
- DRAINAGE DITCH
- CONCRETE
- BOUNDARY CORNER

+ REFERENCE POINT FROM CH_2M-HILL TECHNICAL DOCUMENT NO. 2 DATE 9/16/88 (921700 N; 725900 E)

NOTE: EXISTING FENCE WEST OF AREA 3 TO BE RELOCATED TO NEW LOCATION SHOWN ON THE DRAWING.

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION ZIONSVILLE, INDIANA REMEDIAL AREA BOUNDARIES	FIGURE NO. 2-3
ERM ERM–North Central, Inc.	3/1/89 cs

NOTES:

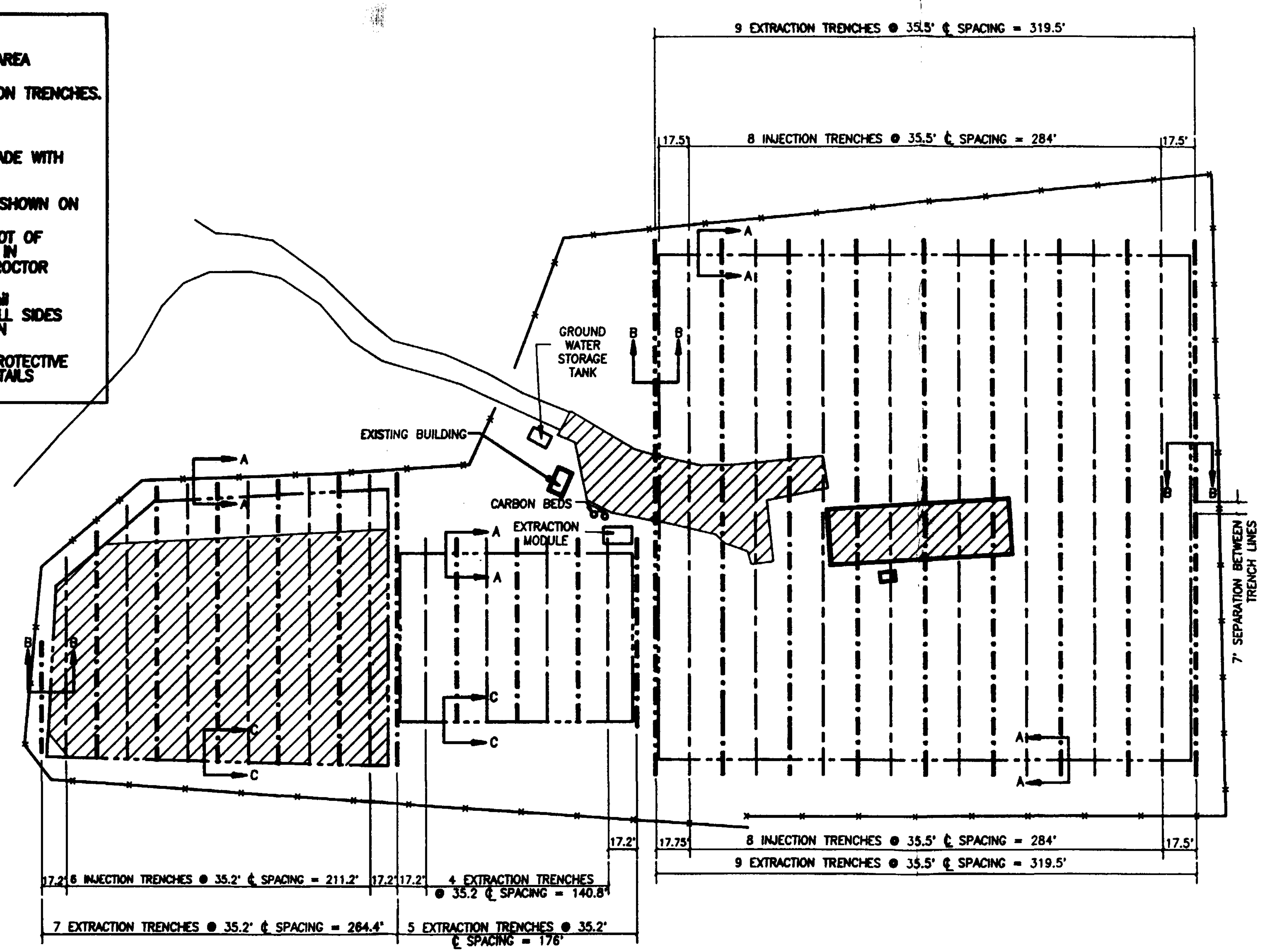
1. GRADE EXISTING TREATMENT SITE (AREA NOS. 1,2, & 3) TO EVEN SLOPE.
2. EXCAVATE INJECTION AND EXTRACTION TRENCHES.
3. FILL INJECTION TRENCHES WITH GRAVEL AS SHOWN ON DETAILS SHEET.
4. FILL EXTRACTION TRENCHES TO GRADE WITH GRAVEL AS SHOWN ON DETAILS SHEET.
5. EXCAVATE DEADMAN TRENCHES AS SHOWN ON SHEET AND DETAILS SHEET.
6. COVER TREATMENT SITE WITH 1 FOOT OF NATIVE SOIL OF 10^{-7} PERMEABILITY IN 6" LAYERS COMPACTED TO 95% PROCTOR DENSITY.
7. COVER TREATMENT SITE WITH 60 mil HDPE PLASTIC LINER ANCHORING ALL SIDES IN DEADMAN TRENCH AS SHOWN ON DETAILS SHEET.
8. COVER TREATMENT SITE WITH 6" PROTECTIVE LAYER OF SAND AS SHOWN ON DETAILS SHEET

APPROX. SCALE (ft)

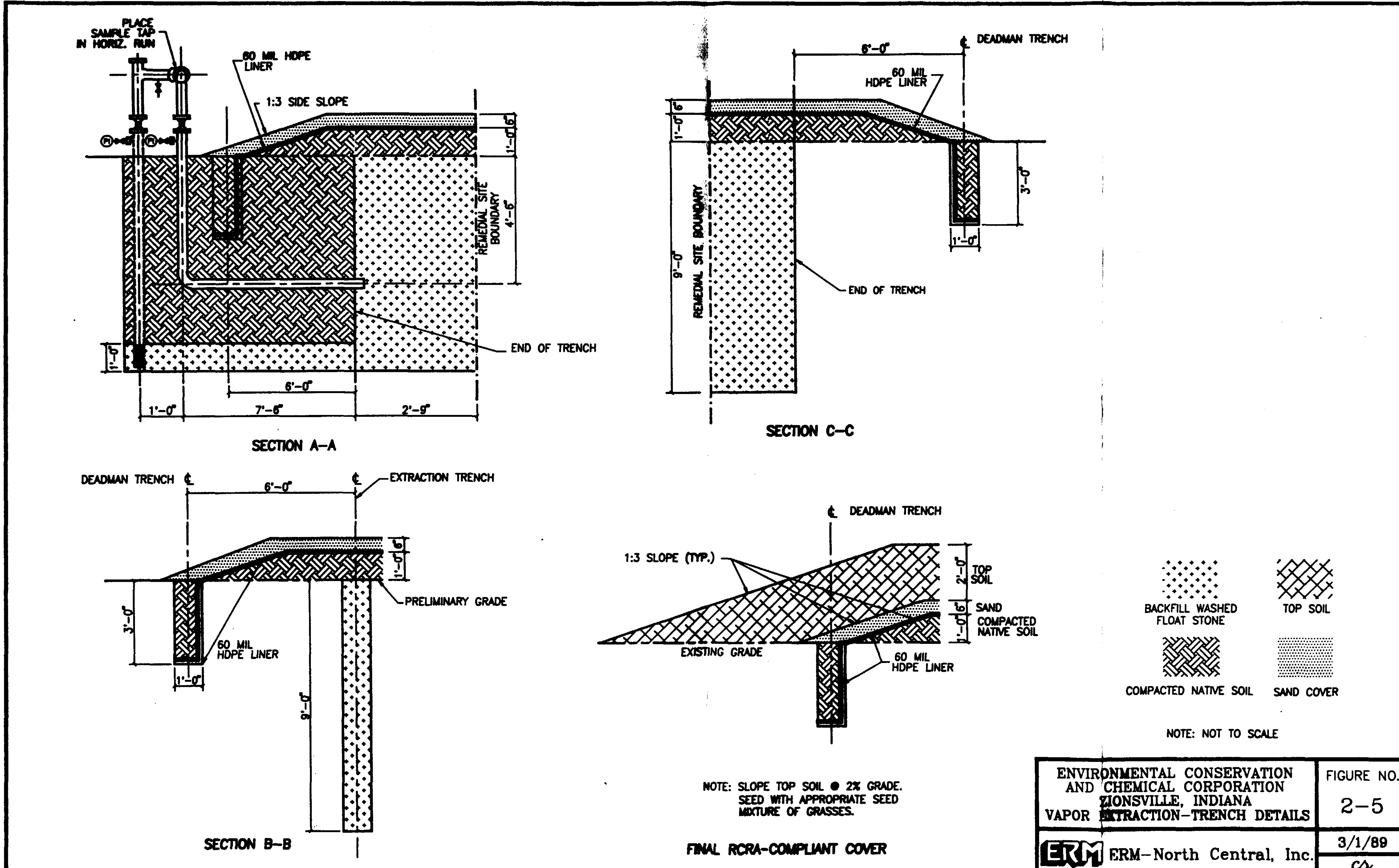
0 25 50 100

LEGEND:

- FENCE LINE
- BUILDING LINE
- PAVEMENT EDGES
- BOUNDARY LINES
- INJECTION TRENCHES
- EXTRACTION TRENCHES
- CONCRETE



ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION ZIONSVILLE, INDIANA SOIL VAPOR EXTRACTION-TRENCH PLAN	FIGURE NO. 2-4
ERM ERM-North Central, Inc.	3/1/89 cs



ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION
ZIONSVILLE, INDIANA
VAPOR EXTRACTION–TRENCH DETAILS

FIGURE NO. 2–5

ERM ERM–North Central, Inc.

3/1/89

cs

the site. The maximum length of any trench will be 165 feet. Construction details of extraction trenches and injection trenches are identical. By implementing minor above-ground piping changes, injection trenches can and will be utilized as extraction trenches. The work required under this RAP will initially involve using the original extraction trenches for extraction; at some point in the process, the extraction trenches will be converted to injection trenches, and vice versa, to ensure complete vapor extraction of the soil.

All trenches are to be a minimum of 9-feet deep as measured from existing grade, and will be backfilled with washed "float" stone. The trench width will be 12-15 inches. Soil removed from the trench excavation will be spread over the surface during construction of the cover system and covered in accordance with the final RCRA-compliant cover detail illustrated in Figure 2-5.

Each trench will be equipped at one end with a vapor extraction pipe and a water collection pipe as illustrated in Section A-A of Figure 2-5. Both pipes will be 4-inch diameter, Schedule 40 PVC. Each pipe segment will be equipped with pressure/vacuum indicator, isolating valve and sample tap. A "T" at the top of the water collection pipe will permit the future installation of air piping to air lift water from the trench network, if necessary. Individual 4-inch, Schedule 40 PVC pipes will be routed from each extraction trench to the extraction module. The extraction module will be located adjacent to the existing concrete pad near the site entrance. Alternatively, two or three extraction trenches will be manifolded together and conveyed to the extraction module via a 4-inch, Schedule 40 PVC pipe. Injection trench piping is identical to the extraction trench piping and, as previously described, will permit it to be utilized as an extraction trench during the operation of the vapor extraction system. To minimize field piping from the extraction module to the injection trenches, 4 to 8 injection trenches will be manifolded together. Four-inch, Schedule 40 PVC pipe will be used to convey air returned from the extraction module to the injection trench.

The EPA Sump will be backfilled with the trench backfill material and a 4-inch PVC pipe will be installed between the sump and the nearest extraction trench, thereby tying the EPA Sump directly into the vapor extraction system.

Soil Vapor Extraction System

The vacuum pump will have a capacity of 500 standard cubic feet per minute (SCFM) and will be capable of developing a vacuum of 18 inches Hg. The normal operating vacuum will be 12 inches Hg. Based on MWRI's experience with soils characteristic of the ECC site and on the Terra Vac pilot study results at the ECC site, the zone of influence at the operating vacuum will be at least 40 feet (20 feet in either side of the trench). The selected spacing between trenches of 17 to 18 feet is well within this zone of influence. The vacuum will be applied at the trench outlet and will be uniformly distributed throughout the entire length and vertical dimension of the trench. The highly porous backfill material used will assure this uniform distribution of vacuum throughout the extraction trench. The reinjection pressure of air in each adjacent injection trench will be approximately 37.4 inches Hg (1.25 atm). Therefore, the pressure differential and driving force for air movement between injection and extraction trenches is approximately 19.4 inches Hg (0.65 atm).

The selection of the design air volume of 500 SCFM is based upon MWRI's experience. The criteria established is to provide at least one air volume change per soil pore volume per day. Based upon an area of treatment of 150,000 square feet, a depth of contamination of 9 feet, and a soil porosity of 10%, 500 SCFM exceeds the MWRI criteria by 400%.

The vacuum pump will operate continuously and will shut down in the event of operating problems such as high operating temperatures, excessive system pressures or vacuums, or high water level in the water collection system. Each trench has a compound pressure gauge which displays the operating pressure/vacuum at each trench.

The air extracted from the system will be continuously monitored by in-line instrumentation as shown on the process flow diagram (Figure 2-2) and described on Table 2-1 (Instrument Summary Sheet). The capability will exist to sample individual trench exhausts or the combined air stream. Sample taps will be provided to collect vapor samples for detailed chemical analysis. The on-line instrumentation will consist of a photoionization detector (PID) and moisture analyzer. The vacuum pump, controls and instrumentation are located in the extraction module building.

Water Collection System

The high vacuum vapor extraction system selected will be capable of entrainment and movement of water which accumulates in the extraction trenches. Any free liquid in the extracted vapor will be separated by gravity in an entrainment separator located in

ENVIROCLEAN - NORTH CENTRAL, INC.
INSTRUMENT SUMMARY SHEET

CLIENT Environmental Conservation and Chemical Corporation

PROJECT NUMBER 8009DSECC

SHEET TABLE 2-1

SPEC NO

DATE 2/28/89

	TAG NO.	SERVICE	MOUNTING PANEL	MOUNTING FIELD	REFERENCES SPEC SHEET	REFERENCES FLOW DIA.	NOTES
	PI-1	Pressure Indicator					
	thru	with diaphragm					
	PI-4	Seal and shutoff cock		X		2-1	
	PE-5	Pressure sensing element					
	PT-5A	Pressure transmitter		X		2-2	
	AE-6	Moisture sensing element		X		2-2	
	AT-7	Moisture transmitter	X			2-2	
	AE-8	Volatile organics detector and quantifier	X			2-2	
	AT-9	Volatile organics quantitifed signal transmitter	X			2-2	
	CC-10	3-point water level control and alarm		X		2-2	
	TS-11	Gas temperature sensor with high level system					
		shutdown switch		X		2-2	
	TS-12	Gas temperature sensor with high level system					
		shutdown switch		X		2-2	
	FE-13	Gas flow measuring element		X		2-2	
	FE-14	Gas flow signal transmitter		X		2-2	
	LC-15	3-point water level control and alarm		X		2-2	

the vapor extraction module building. A level control system will be utilized to control the removal of water which accumulates in the entrainment separator as required. The separator tank is equipped with a vacuum breaker system which will open the tank to the atmosphere to permit water to be transferred by pump from the separator to an on-site water storage tank. The size of the tank will depend upon the off-site handling/treatment option selected. The tank will be equipped with level measurement and control to advise operating personnel to the status of liquid accumulation in the storage tank.

Periodically, the contents of the water storage tank will need to be removed. The removed water will either be sent to the Indianapolis POTW via the NSL pipeline or truck, or to another off-site facility for handling and treatment as necessary. Any such off-site transportation and handling will be in accordance with all applicable federal, state and local requirements.

Carbon Adsorption System

From the water entrainment tank, the air passes through a particulate filter preceding the vacuum pump. The exhaust from the vacuum pump will be piped directly to a two-stage carbon adsorption system (primary and secondary). This system will consist of two vessels in series each containing approximately 1,800 pounds of granular activated carbon. The organics contained in the extracted air will be adsorbed on the activated carbon. The moisture content of the air stream will be less than 50% relative humidity and temperatures will be approximately 150°F, both acceptable for efficient operation of carbon adsorption.

During the initial phases of operation, when organics concentrations in the air stream will be highest, the carbon capacity for the organics is expected to be about 25% by weight. During the latter phases of remediation as organic concentration of vapor decreases, the projected carbon capacity for organics will range between 10-15% by weight. Based upon an assumed total mass of organics of about 5,000 pounds (Appendix A), the total quantity of activated carbon required for the entire remediation program is 25,000 pounds. This equates to fourteen 1800-pound carbon vessels for the entire program.

The vapor from the primary carbon vessel will be monitored frequently (approximately once per hour) by an on-line PID analyzer. When the PID analyzer detects organic vapor in the air stream between the primary and secondary carbon vessels, the vacuum extraction system will shut down automatically to permit the removal and replacement of the "spent" primary carbon vessel. An operator will be alerted to this condition, and will disconnect the primary carbon bed from the service. The spent carbon vessel will be removed and replaced by a carbon vessel containing fresh activated carbon. The unit previously serving as the secondary carbon bed will become the primary carbon bed and the unit just placed in operation will be the secondary carbon bed. Once this switch is complete, the soil vapor extraction system (i.e., vacuum pump and injection pump) will be restarted, and the system operation resumed. The arrangement of two activated carbon vessels in series (i.e., primary and secondary) will permit optimal utilization of the activated carbon, and efficient capture of the organics.

The spent carbon vessels will be stored on-site. Periodically when a truckload quantity of vessels has accumulated, and at the conclusion of the vacuum extraction program, the vessels containing the spent carbon will be transported in accordance with applicable federal, state and local requirements to an off-site facility where the carbon will be regenerated by high temperature incineration, and in the process, the organics adsorbed on the carbon will be destroyed.

Air Injection System

The exhaust air from the secondary carbon bed will be piped to the injection pump located in the extraction module building. The injection pump will be capable of delivering 500 SCFM at 10 psig (1.65 atm). The discharge from the injection pump will be distributed to the 26 injection wells via a system of manifolds. Control of the injection pump will be interlocked with the vacuum extraction pump. The pipe at each injection trench will be equipped with a pressure/vacuum gauge so that injection pressure at the trench can be periodically monitored.

During the soil vapor extraction program, the injection trenches will be utilized as extraction trenches and vice versa. This can be accomplished by minor above ground manifold piping modifications. It is also planned that as the Cleanup Standards set forth in Table 3-1 below are met for individual trench "areas", the corresponding extraction and injection trenches will be isolated from the extraction and injection operation by closing the shut off valves located at each trench. This will permit the soil vapor extraction system to concentrate on any remaining areas which have not fully achieved the Cleanup Standards specified in Table 3-1, thereby accelerating cleanup of those areas.

RCRA Compliant Cover

The operation of the vapor extraction system will be enhanced by the installation of a RCRA-compliant cover over the entire site. The final cover will be installed to seal the surface during the vapor extraction program. Details of the final cover are presented in Section 2.1.2.

Miscellaneous

- Each extraction trench is equipped with two sample taps, one on the vacuum pipe and one on the water collection pipe. Each of these taps can be fitted with a sample bottle for the collection of free moisture.

- Electrical service required for the site remediation work will be 3-phase 460 volt. Total electrical demand will be approximately 100 KVA. Power distribution will be to the extraction module building. Operating voltage for the extraction and injection pumps will be 460 volts. A 110 volt supply will be provided for miscellaneous site lighting, equipment, instrumentation and controls. Power distribution to any site construction and office trailers will also be provided.

- Prior to construction of the trenches, the following activities will be conducted (although not necessarily by the Settling Defendants):

  1. The existing buildings will be demolished and disposed of off-site;

  2. The existing tanks removed and properly disposed of off-site; and

  3. The site will be graded to fill existing depressions and to eliminate any sharp grade changes.

- As discussed in more detail in Section 3.7 below, if the Cleanup Standards set forth in Table 3-1 are not achieved within 5 years, additional work may need to be implemented (<u>see</u> Section 3.7 for details).

2.1.2 RCRA-Compliant Cover

The RCRA-compliant cover installed over the site will:

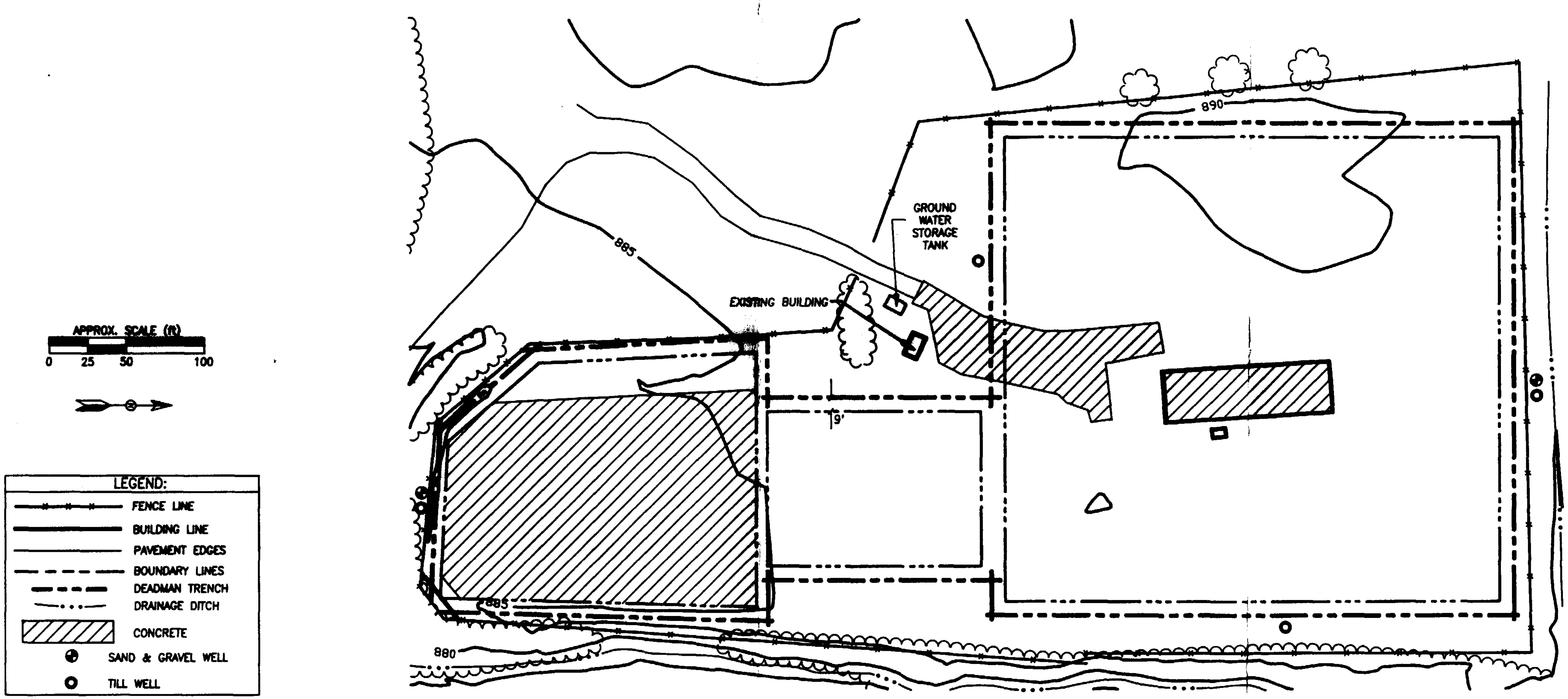
- Prevent contact with underlying soil;

- Prevent contamination of surface runoff;

- Reduce the infiltration of water through the soils thereby preventing ground water and subsequent surface water contamination;
- Enhance the efficiency of the soil vapor extraction system;
- Promote evapotranspiration;
- Promote drainage of precipitation away from the site; and
- Mitigate erosion.

The RCRA-compliant cover will consist of a 1-foot layer of compacted, highly impermeable native soil, a continuous welded 60 millimeter high density polyethylene (HDPE) plastic membrane, a minimum 6-inch layer of compacted sand for drainage, and from 2 to 5 feet of top soil to support vegetation (Figure 2-5). The final grading plan will ensure a minimum slope of 2%. The native soil used will be the silty clay till available in the area, which can and will be compacted by standard methods to a permeability of 10^{-7} or less. If soil from the NSL borrow area is not available, material with similar performance will be obtained from another source.

To provide a perimeter seal of the HDPE membrane, a 3 foot deep "deadman trench" will be installed around the site boundary (Figure 2-6). The HDPE membrane will be draped into this trench. The trench will then be backfilled and compacted with native soil (silty clay till) to a permeability of 10^{-7} or less.



NOTE: "DEADMAN" TRENCH TO BE LOCATED APPROXIMATELY 9' BEYOND REMEDIAL SITE BOUNDARIES (ALL SIDES)

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION ZIONSVILLE, INDIANA DEADMAN TRENCHING PLAN	FIGURE NO. 2-6
ERM ERM-North Central, Inc.	3/1/89 cs

As previously described, the material excavated from the trenches will be graded uniformly throughout the trench area and disced into the top 6 to 12 inches of existing surface soil prior to the construction of the final cover detail.

The RCRA-compliant cover will be installed over the entire site, including the concrete pad, prior to initiation of the vapor extraction process. At completion of the soil vapor extraction program all surface piping will be removed from the site in addition to any equipment, buildings or trailers. The extraction and injection trench piping will be cut off at the current grade, filled with grout, and covered with a minimum of 1 foot of topsoil, which will be vegetated. Vegetation which will be established will be characterized by fibrous, shallow, laterally growing roots, such as grass (which may include red fescue and Kentucky blue grass).

2.1.3 Access Restrictions

The objectives of implementing access restrictions are to:

- Prior to implementation of the RAP, to minimize the potential for contact with any soils and water containing VOCs, base neutral/acid organics, and heavy metals; and

- Prevent any contaminant migration that might result from future excavation and development.

Access restrictions (which may not be the responsibility of Settling Defendants) will consist of:

- o Fencing around the site perimeter and posting of signs;

- o Filing of appropriate restrictions with the County Recorder's Office prohibiting usage of the site for excavation and development;

- o Filing of appropriate restrictions with the County Recorder's Office prohibiting usage of ground water from the saturated till and the underlying sand and gravel; and

- o Filing of appropriate restrictions with the County Recorder's Office prohibiting installation of new water wells other than monitoring wells.

Ground water use restrictions would be only temporary and will be in place until compliance with the ground water Cleanup Standards in Table 3-1 is achieved and, until such time, will extend to areas where utilization of the shallow ground water could potentially result in contamination being drawn to these locations.

2.1.4 Ground Water and Surface Water Monitoring

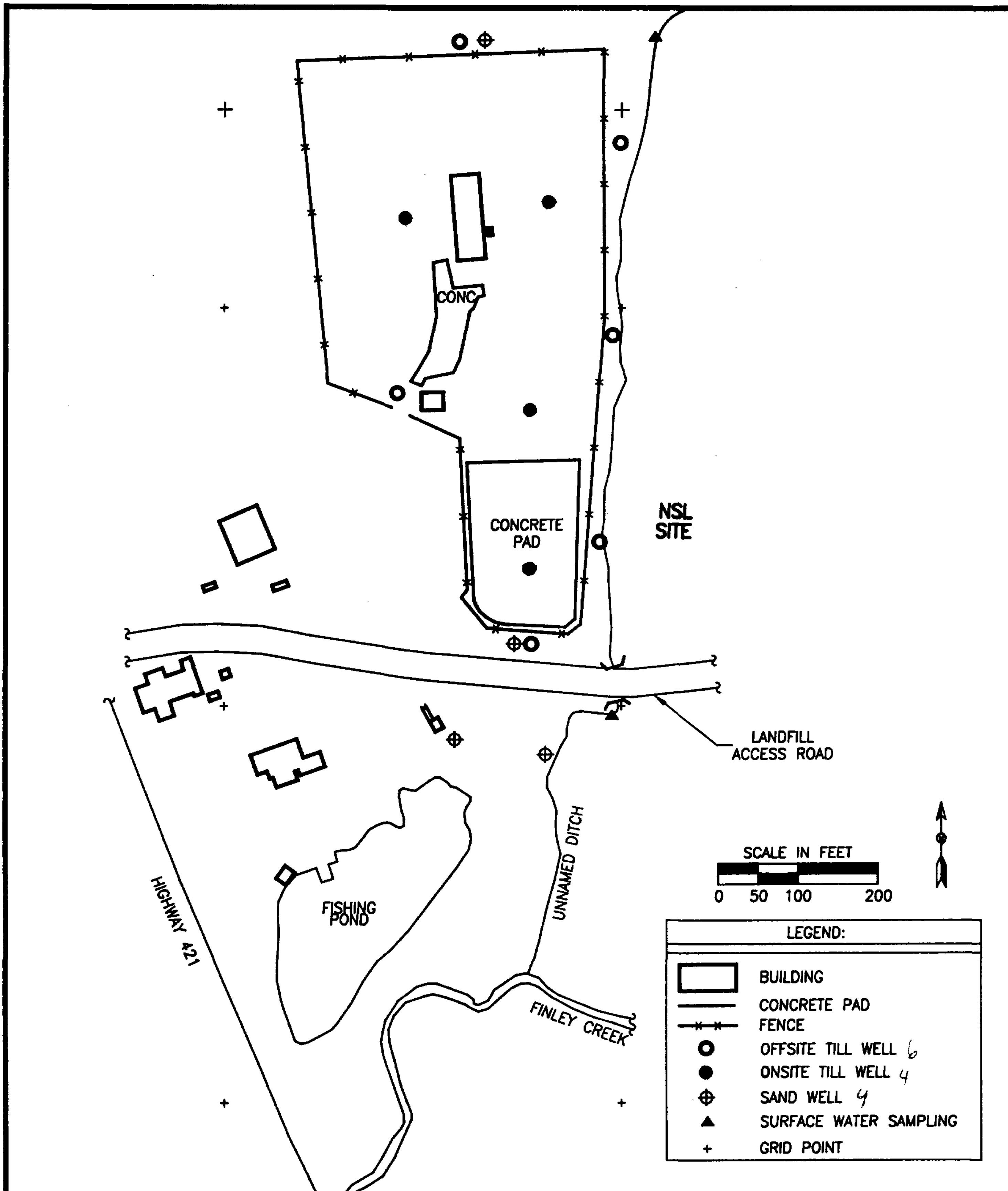
The monitoring activities will:

- o Detect any VOCs migration to the ground water and surface water; and

- o Monitor and verify the effectiveness of the remediation.

Two separate types of ground water monitoring systems will be operated under this RAP. The first is the on-site till monitoring system described in Section 4.0 below; sampling results from those wells will be compared to the ground water Cleanup Standards in Table 3-1 and will be used to calculate soil concentrations for comparison to the soil Cleanup Standards in Table 3-1.

The second type of ground water monitoring system involves off-site wells screened in the till and in the sand and gravel. Sampling results from these wells will also be used to determine compliance within the ground water Cleanup Standards in Table 3-1. This latter ground water monitoring network will consist of ten (10) wells, which will be located around the periphery of and downgradient from the ECC site (Figure 2-7). Six (6) wells will be installed in the till, completed in the saturated zone, and four (4) wells will be completed in the sand and gravel unit underlying the saturated surface till. The wells will be constructed of 2-inch PVC pipe. Screen length will vary for each well. Total depth for the wells completed in the till will be 1-



SURFACE WATER AND GROUND WATER SAMPLING LOCATIONS	FIGURE 2-7
ERM-North Central, Inc.	3/1/89 mo

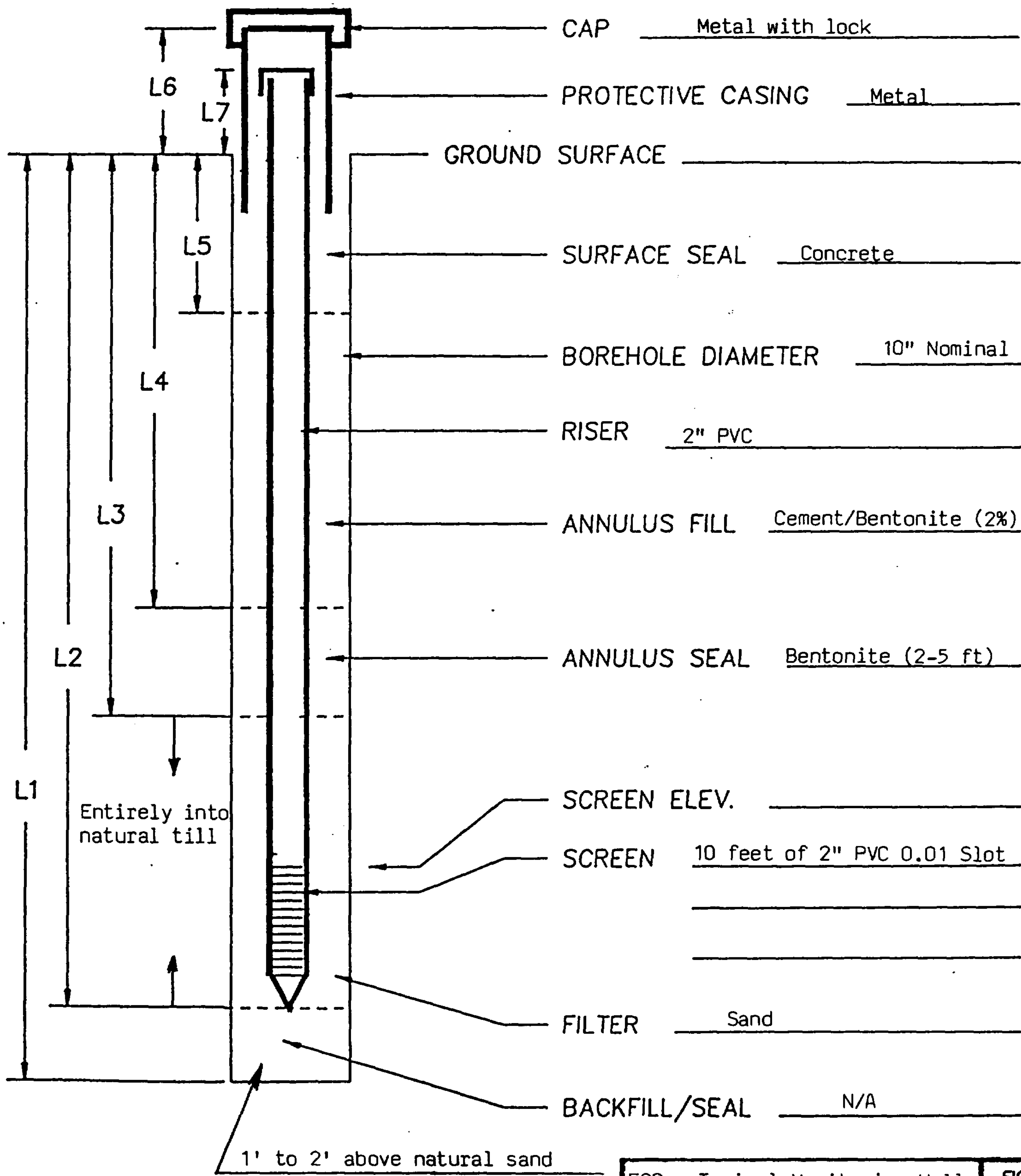
2 feet less than total depth to the contact between the till and underlying sand and gravel. Wells completed in the sand and gravel will screen the total thickness of that sand and gravel unit. Figures 2-8 and 2-9 illustrate well construction details for the ground water monitoring wells in the till and in the sand and gravel, respectively. The location of the monitoring wells is based on the ground water elevation contours shown in Figure 2-10.

Samples from the off-site wells will be collected quarterly during site soil remediation and analyzed for the parameters in Table 3-1. Monitoring will be continued on a semi-annual basis as specified below.

The surface water will be monitored by sampling the Unnamed Ditch just upgradient and just downgradient of the ECC site as depicted in Figure 2-7. Surface water will be sampled at the same frequency as ground water and analyzed for the same parameters.

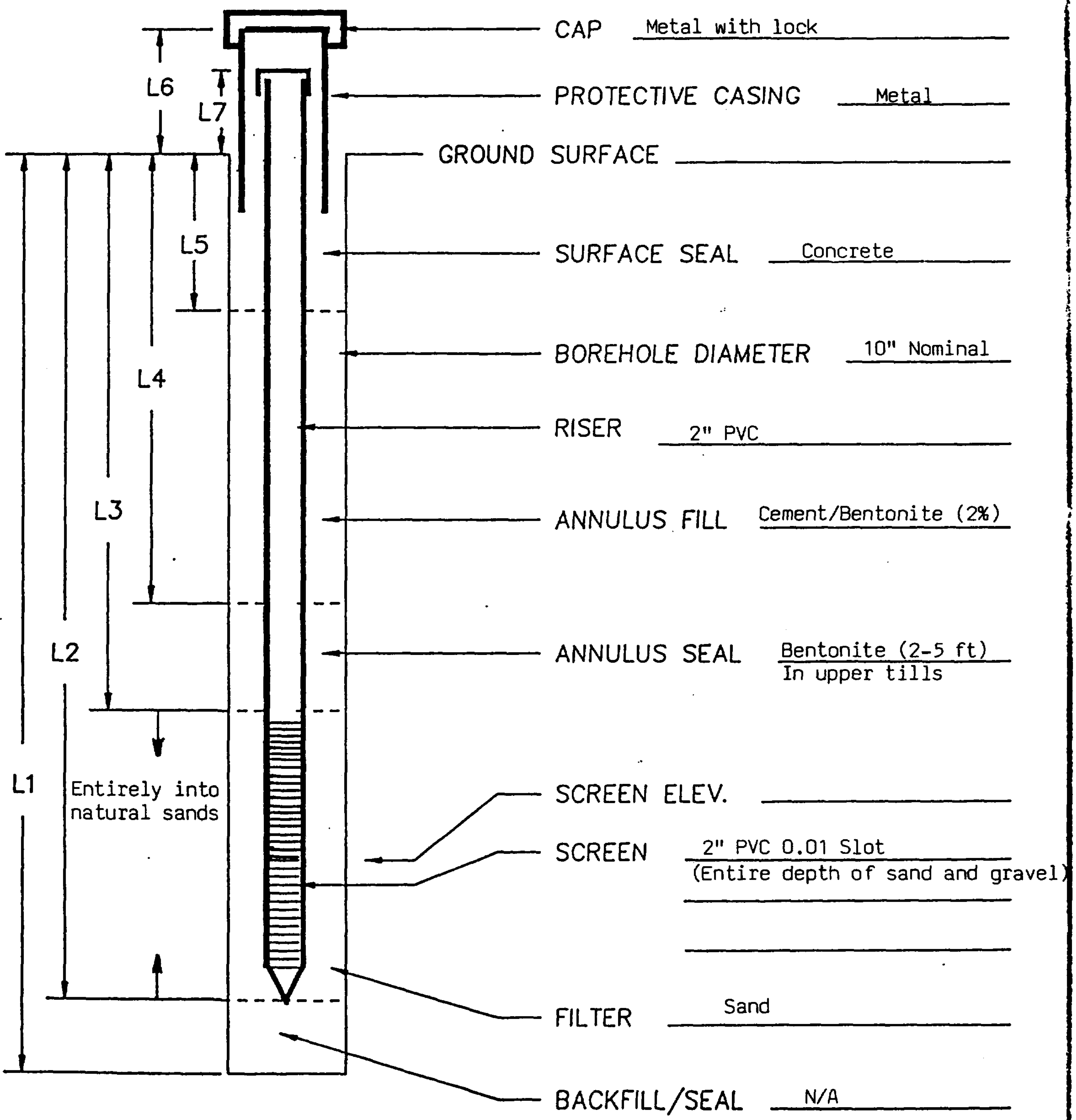
The semi-annual ground and surface water monitoring called for in this Section 2.1.4 will terminate as follows: As mentioned above, this RAP calls for sampling certain on-site ground water monitoring wells screened in the till. As discussed in Section 4.0, once the laboratory analyses of samples from these on-site till wells in two consecutive, quarterly sampling events lead to the demonstration that the soil Cleanup Standards in Table 3.1 have been met, sampling of the on-site till wells will be discontinued. Once that has occurred, sampling of the off-site wells and surface water under this Section 2.1.4 will be terminated when two consecutive, semi-annual sampling events reveal that none of the Cleanup Standards in Table 3-1 have been exceeded for the appropriate media. If such standards are not

MONITORING WELL CONSTRUCTION

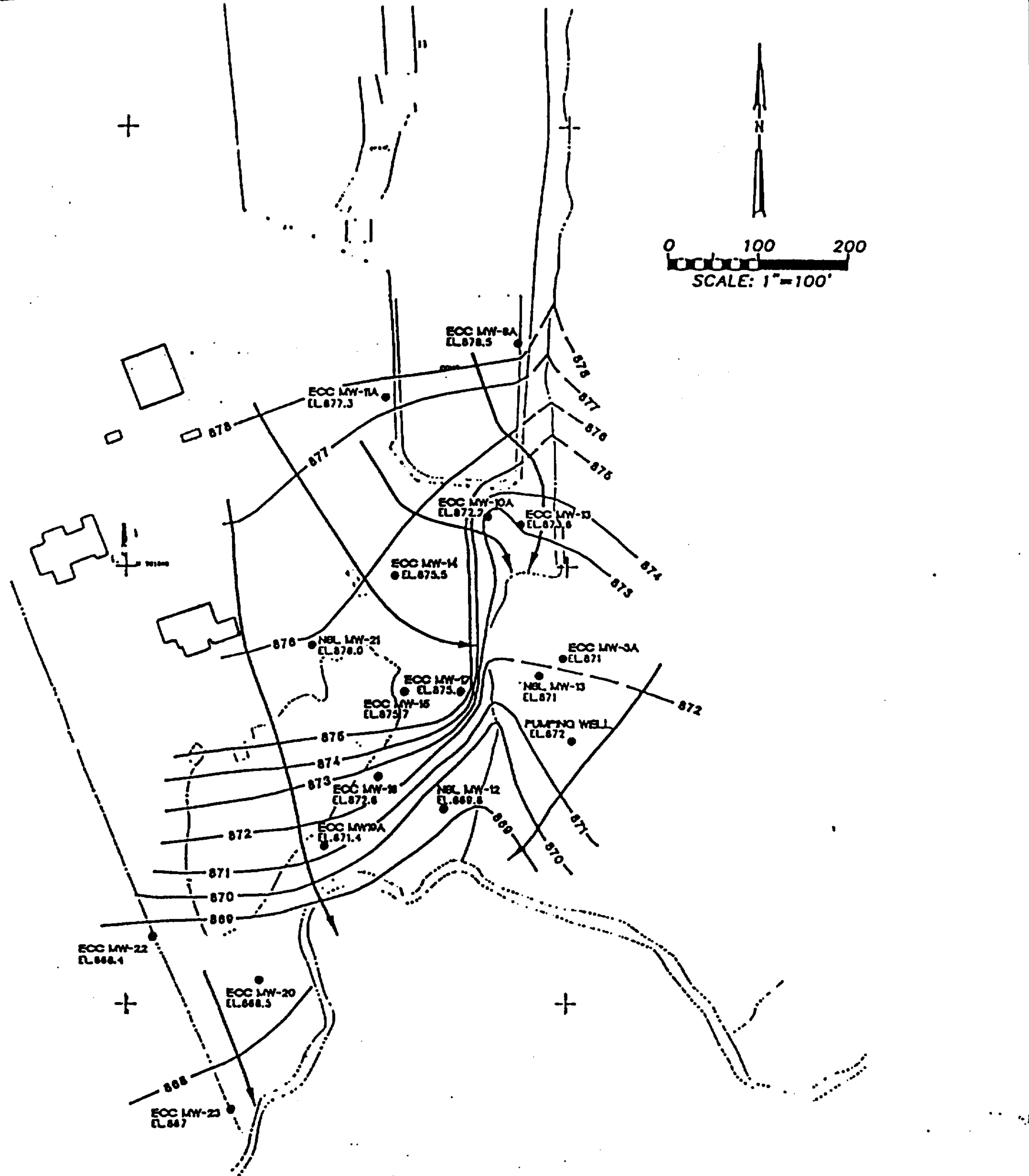


ECC - Typical Monitoring Well Construction Detail Well in Glacial Till	FIGURE 2-8
ERM-North Central, Inc.	

MONITORING WELL CONSTRUCTION



ECC - Typical Monitoring Well Construction Detail Well in Sand & Gravel	FIGURE 2-9
ERM ERM-North Central, Inc.	



LEGEND

—868— POTENTIOMETRIC SURFACE CONTOUR FOR SAND AND GRAVEL AQUIFER. CONTOUR INTERVAL: 1 FOOT.

– – 868 – – INFERRED POTENTIOMETRIC SURFACE CONTOUR

———→ DIRECTION OF GROUNDWATER MOVEMENT IN SURFICIAL AQUIFER

NOTE: Contours have been drawn to suggest that the pond is not hydraulically connected to the sand and gravel aquifer. This relationship has not been fully established.

From CH2M HILL Technical Memorandum No. 2, dated September 16, 1988.

POTENTIOMETRIC SURFACE MAP OF UPPER SAND AND GRAVEL AQUIFER

FIGURE 2-10

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achieved for the on-site till wells, off-site wells, or surface water, then additional monitoring activities under Section 3.7 may need to occur.

3.0 REMEDIAL ACTION CLEANUP STANDARDS

This section presents site-specific Cleanup Standards to be used at the ECC site to determine the end point of remediation activities and to accomplish clean closure of the site. Achieving these standards will result in the cleanup of the soil and ground water at the site so that without any further remedial action thereafter, the site will not adversely affect any environmental media, including ground water, surface water, or the atmosphere, and so that direct contact through dermal exposure, inhalation, or ingestion will not result in a threat to human health or the environment. As discussed in Section 3.7 below, if these standards are not achieved in 5 years, then alternative Additional Work as described in Section 3.7 may need to be undertaken.

Sections 3.1 through 3.6 describe the standards to be met to achieve a clean closure.

3.1 Cleanup Standards

To accomplish clean closure of the site, the following Cleanup Standards will be met:

- o Soil concentrations will not exceed the soil levels shown in Table 3-1;

TABLE 3-1 (Page 1 of 2)
SITE-SPECIFIC CLEANUP STANDARDS
ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION (ECC) SITE

Compounds	Acceptable Ground Water Concentration (1) (ug/l)		Acceptable Stream Concentration (2) (ug/l)	Acceptable Soil Concentration Value (ug/kg)	Method
VOLATILE ORGANICS (VOCs):					
Acetone	3,500	RB		490	(3)
Chlorobenzene	1,050	RB		177,000	(3)
Chloroform	100	MCL	15.7	2,300	(3)
1,1-Dichloroethane	0.38	RB		5.7	(3)
1,1-Dichloroethene	7	MCL	1.85	120	(3)
Ethylbenzene	3,500	RB	3,280	1,200,000	(3)
Methylene Chloride	4.7	RB	15.7	20	(3)
Methyl Ethyl Ketone	1,750	RB		780	(3)
Methyl Isobutyl Ketone	1,750	RB		8,900	(3)
Tetrachloroethene	0.69	RB	8.85	130	(3)
Toluene	10,500	RB	3,400	1,250,000	(3)
1,1,1-Trichloroethane	200	MCL	5,280	7,200	(3)
1,1,2-Trichloroethane	0.61	RB	41.8	22	(3)
Trichloroethene	5	MCL	80.7	240	(3)
Total Xylenes	70,000	RB		31,000,000	(3)
BASE NEUTRAL/ACID ORGANICS:					
Bis(2-ethylhexyl)phthalate	2.5	RB	50,000	50,000	(4)
Di-n-Butyl Phthalate	3,500	RB	154,000	8,500,000	(4)
Diethyl Phthalate	28,000	RB	52,100	11,300,000	(3)
Isophorone	8.5	RB		52	(3)
Naphthalene	14,000	RB	620	3,480,000	(3)
Phenol	1,400	RB	570	9,800	(3)
INORGANICS:					
Antimony	14	RB		500,000	(5)
Arsenic	50	MCL	(6)	97,000	(5)
Barium	1,000	MCL		5,000,000	(5)
Beryllium	175	RB		7,000	(5)
Cadmium	10	MCL		10,000	(5)
Chromium	50	MCL	11	1,500,000	(5)
Lead	50	MCL	10	700,000	(5)
Manganese	7,000	RB		7,000,000	(5)
Nickel	700	RB	100	700,000	(5)
Silver	50	MCL		5,000	(5)
Tin	21,000	RB		20,000	(5)
Vanadium	245	RB		500,000	(5)
Zinc	7,000	RB	47	2,000,000	(5)
Cyanide	700	RB	5.2	1,700,000	(4)
PESTICIDES/PCBs:					
PCBs				10,000	(7)

TABLE 3-1 (Page 2 of 2)

NOTES:

(1) MCL = Drinking water Maximum Contaminant Level. 40 CFR 141.
RB = risk-based standard. U.S. EPA, Draft RCRA Facility Investigation Guidance, 1987.

(2) Stream Criteria, from Table 1 of the Record of Decision for the site, September 25, 1987.

(3) Acceptable soil value is based on ingestion of ground water at the site boundary, assuming a dilution of leachate to ground water of 1:196 (Appendix B).

(4) Acceptable soil value is based on ingestion of soil, assuming an ingestion rate of 0.2 grams of soil per day by a 17 kilogram child, as per the RCRA Facility Investigation Guidance and the EPA Memorandum on Interim Final Guidance for Soil Ingestion Rates.

(5) Upper limit of background concentrations listed in U.S. Geological Survey, Background Geochemistry of Some Rocks, Soils, Plants, and Vegetables in the Conterminous United States, Professional Paper 574-F, 1975.

(6) Value in Table 1 of the ROD is below treatability and detection limits.

(7) 40 CFR Part 761.125 . Polychlorinated Biphenyls Spill Cleanup Policy Rule.

- Surface water concentrations from (ECC in Unnamed Ditch south of the site) above the levels shown in Table 3-1 will be prevented; and

- Ground water concentrations above the levels shown in Table 3-1 in the till and sand and gravel monitoring wells will be prevented.

3.2 Calculation of Cleanup Standards

Table 3-1 lists the Cleanup Standards. The equations for calculation of the risks, supporting data and complete references are included in Appendix B.

The calculation of risk-based concentrations shown in Table 3-1 follows the procedures presented in the USEPA Draft RCRA Facility Investigation (RFI) Guidance, July, 1987, and in the USEPA Memorandum on Interim Final Guidance for Soil Ingestion Rates, January 27, 1989. The assumed ingestion rates for soil are either 0.1 grams of soil per day for a 70 kilogram person for 70 years (for compounds with potency factors) or 0.2 grams of soil per day for a 17 kilogram child for 5 years (for compounds with reference doses). The ingestion rate for ground water is 2 liters of water per day by a 70 kg person for 70 years.

Three columns of data, corresponding to ground water, surface water, and soil Cleanup Standards, are presented in Table 3-1. Ground water concentrations are based on either the drinking water Maximum Contaminant Level (MCL) or the appropriate risk-based concentration. These limits assume, as a worst case, that the ground water in the till could be utilized as a lifetime source of drinking water. However, the use of the ground water in the till as a source of drinking water was rejected as infeasible in the ECC Remedial Investigation (RI), page 6-22. As a result, the use of drinking water standards and risk-based standards based upon daily, long-term human consumption of the till water for Cleanup Standards under this RAP represents an extremely conservative assumption when the real-life risks presented by the ECC site are considered.

Surface water concentrations are taken from the Record of Decision (ROD) for the site, dated September 25, 1987.

Soil concentrations are selected in the following order: (1) regulated cleanup level, such as for PCBs; (2) background concentrations, such as for metals; or (3) lowest of the risk-based concentrations for soil or ground water ingestion.

Table 3-2 presents the compounds detected in soils at the site at levels above the Cleanup Standards specified in Table 3-1. Table 3-3 shows the vapor pressure and solubility of these compounds.

3.3 Volatile Organics (VOCs)

The vapor extraction system to be installed at the site will reduce the current VOCs soil concentrations to the levels shown in Table 3-1. VOC concentrations in ground water in the till and sand and gravel will also be reduced to the levels specified in Table 3-1 by eliminating the source of VOCs, and by extracting ground water from the till in the zone of treatment during the vapor extraction activities.

TABLE 3-2
COMPOUNDS DETECTED IN THE SOIL AT CONCENTRATIONS ABOVE THE SITE-SPECIFIC SOIL CLEANUP STANDARDS

Compound	Soil Concentration (ug/kg) Cleanup Standard	Maximum Detected Concentration
VOLATILE ORGANICS (VOCs):		
Acetone	490	650,000
Chloroform	2,300	2,900
1,1-Dichloroethane	5.7	35,000
1,1-Dichloroethene	120	380
Ethylbenzene	1,200,000	1,500,000
Methylene Chloride	20	310,000
Methyl Ethyl Ketone	780	2,800,000
Methyl Isobutyl Ketone	8,900	190,000
Tetrachloroethene	130	650,000
Toluene	1,250,000	2,000,000
1,1,1-Trichloroethane	7,200	1,100,000
1,1,2-Trichloroethane	22	550
Trichloroethene	240	4,800,000
BASE NEUTRAL/ACID ORGANICS:		
Bis(2-ethylhexyl)phthalate	50,000	370,000
Isophorone	52	440,000
Phenol	9,800	570,000
PESTICIDES/PCBs:		
PCBs	10,000	39,000
INORGANICS:		
Cadmium	10,000	27,000

TABLE 3-3
CHEMICAL PROPERTIES OF COMPOUNDS DETECTED IN THE SOILS ABOVE CLEANUP STANDARDS

Compound	Solubility (ug/l)	Vapor Pressure (mm Hg)
VOLATILE ORGANICS (VOCs):		
Acetone	1,000,000,000	270
Chloroform	8,200,000	151
1,1-Dichloroethane	5,500,000	182
1,1-Dichloroethene	2,250,000	600
Ethylbenzene	152,000	7
Methylene Chloride	20,000,000	362
Methyl Ethyl Ketone	268,000,000	77.5
Methyl Isobutyl Ketone	17,000,000	6
Tetrachloroethene	200,000	17.8
Toluene	535,000	28.1
1,1,1-Trichloroethane	4,400,000	123
1,1,2-Trichloroethane	4,500,000	30
Trichloroethene	1,100,000	57.9
BASE NEUTRAL/ACID ORGANICS:		
Bis(2-ethylhexyl)phthalate	1,300	0.0000002
Isophorone	12,000	0.38
Phenol	93,000,000	0.341
PESTICIDES/PCBs:		
Aroclor-1232	1,450	0.00406
Aroclor-1260	2.7	0.0000405

REFERENCES:

U.S. EPA, Superfund Public Health Evaluation Manual, 1986.

U.S. EPA, Water-Related Environmental Fate of 129 Priority Pollutants, December 1979.

3.4 Base Neutral/Acid Organics

With the vapor pressures shown in Table 3-3, isophorone and phenol will be reduced to acceptable levels by the vapor extraction system.

Bis(2-ethylhexyl)phthalate (EHP) will not be significantly extracted by soil vapor extraction due to its low vapor pressure (see Table 3-3). However, EHP does not and will not present any risk to human health or the environment. First, EHP was only detected in 8 of 35 samples at the site. Second, EHP is easily biodegraded under aerobic conditions, with a half life of about two weeks (USEPA, Water-Related Environmental Fate of 129 Priority Pollutants, December, 1979). The vapor extraction system to be implemented by Settling Defendants will create an aerobic environment conducive to accelerated biodegradation of EHP even beyond that which may have occurred since the RI samples were taken in 1984. Third, EHP has a high affinity for organic carbon in soil. As a result, any amount of EHP that may remain in the soil is unlikely to adversely impact ground water because it will be chemically fixed to the soil and because the RCRA-compliant cover will substantially reduce (by 99%) infiltration through the soil. The RCRA compliant cover will also eliminate any potential for risk from any possible contact with or migration of EHP. Finally, the ground water and surface water Cleanup Standards that are part of this RAP will ensure that ground water and surface water are protected from adverse impacts.

As a result of the comprehensive remedy to be implemented by Settling Defendants, no route of exposure (air, ground water, surface water, or direct contact/ingestion) will create a risk to human health or the environment.

3.5 Pesticides/PCBs

Due to their low vapor pressures (Table 3-3), the PCBs will also not be removed by vacuum vapor extraction. However, PCBs also will not present any risk to human health or the environment. First, PCBs were detected above the soil Cleanup Standards at only one location (TP-9, 1-2') and only detected at any level in 6 of 35 soil samples collected at the site. It is also noteworthy that PCBs have never been detected in any ground water monitoring wells at and around the site. Second, PCBs have an extremely low solubility and a very high affinity for organic carbon in soil and are, therefore, chemically fixed to the soil and immobile at the site. As a result, any amount of PCBs remaining in the soil is unlikely to adversely impact ground water. Moreover, the RCRA-compliant cover will substantially reduce (by 99%) infiltration through the soil thereby further protecting the environment. Finally, the RCRA-compliant cover will eliminate any potential for risk from any possible contact with or migration of PCBs.

As a result of the measures to be implemented by Settling Defendants, no route of exposure (air, ground water, surface water, or direct contact/ingestion) will create a risk to human health or the environment.

3.6 Inorganics

Cadmium was the only inorganic compound detected at the site at concentrations above the respective Cleanup Standards specified in Table 3-1. However, cadmium also does not and will not present any risk to human health or the environment. First, and like PCBs, cadmium was only detected above the cleanup standards at one location (TP-8, 2.5-4'). Second, cadmium was only detected in 6 of 36 soil samples collected at the site for inorganics analysis. Third, cadmium is an element which occurs naturally in the environment; its presence likely results from natural weathering processes of soil in the environment. Fourth, any amount of cadmium remaining in the soil is unlikely to adversely impact ground water because the RCRA compliant cover will substantially reduce (by 99%) infiltration through the soil. Fifth, the RCRA compliant cover will eliminate any potential for risk from any possible contact with or migration of cadmium. Finally, the ground water and surface water cleanup standards that are part of this RAP will ensure that ground water and surface water are protected from adverse impacts. As a result, no route of exposure for cadmium (air, ground water, surface water, or direct contact/ingestion) will create a risk to human health or the environment.

3.7 Additional Work

If Additional Work is required under Section VII of the Consent Decree, Settling Defendants shall either perform such Additional Work as the Parties may agree or shall arrange with a Contractor to perform the following additional work at the site:

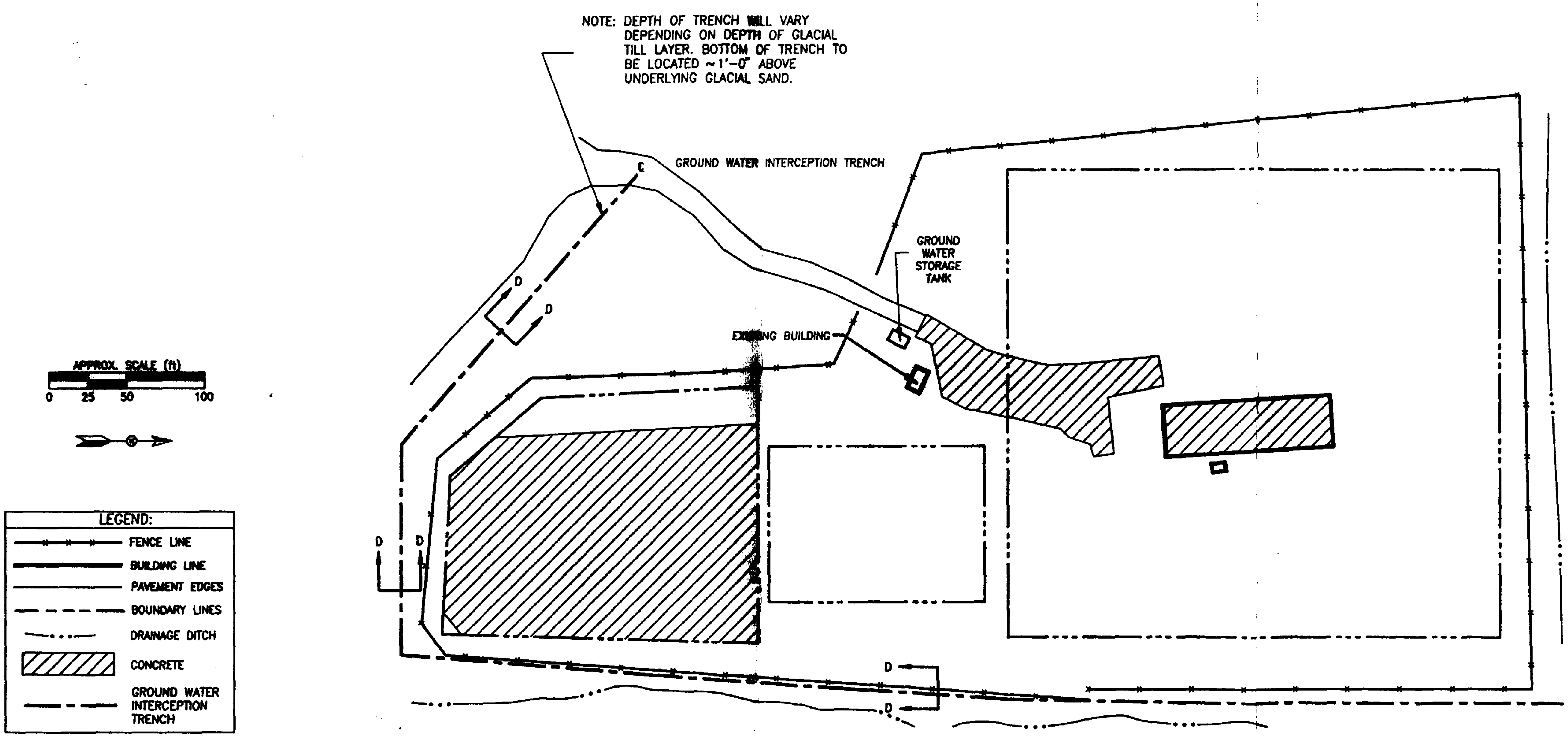
- The RCRA-compliant cover will be maintained and access and land use restrictions will remain in effect.

- If ground water beneath the site exceeds the Cleanup Standards in Table 3-1, a ground water interception trench will be constructed around the south and east sides of the ECC site as depicted in Figures 3-1 and 3-2.

- Ground water that exceeds the Cleanup Standards in Table 3-1 will be collected in this trench, pumped out and transported to the Indianapolis POTW (via the NSL pipeline or tank truck), or to such other facility, for appropriate handling and treatment in accordance with federal, state and local requirements.

- Ground water will continue to be collected and treated in this manner until two consecutive, semi-annual ground water samples collected from the trench show that the ground water Cleanup Standards in Table 3-1 have been met unless the Parties to the Decree otherwise agree or the Court orders that said remedial action may be terminated.

- Semi-annual ground water sampling and monitoring will continue so long as ground water continues to be collected.



ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION
ZIONSVILLE, INDIANA
GROUND WATER INTERCEPTION TRENCH

FIGURE NO. 3-1

ERM ERM-North Central, Inc.

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TABLE B7

ECC - ACCEPTABLE SOIL CONCENTRATIONS BASED ON GROUND WATER INGESTION AT THE SITE (RANGE OF RISKS)

Compound (1)	Range of Kd (2)	Acceptable Soil Concentration (3)	
		Range for 10-4 risk	Range for 10-7 risk
VOLATILE ORGANICS (VOCs):			
Acetone	0.000058-0.0044	40-3,019	40-3,019
Chlorobenzene	0.069-5.24	14,200-1,080,000	14,200-1,080,000
Chloroform	0.0093-0.71	182-13,900	182-13,900
1,1-Dichloroethane	0.0062-0.47	46.2-3,500	0.046-3.50
1,1-Dichloroethene	0.0069-0.52	9.47-714	9.47-714
Ethylbenzene	0.14-10.7	96,800-7,340,000	96,800-7,340,000
Methylene Chloride	0.0018-0.14	166-12,900	0.166-12.9
Methyl Ethyl Ketone	0.00018-0.014	61.8-4,800	61.8-4,800
Methyl Isobutyl Ketone	0.0021-0.16	721-54,900	721-54,900
Tetrachloroethene	0.076-5.78	1,028-78,200	1.03-78.2
Toluene	0.049-3.72	101,000-7,660,000	101,000-7,660,000
1,1,1-Trichloroethane	0.015-1.14	588-44,700	588-44,700
1,1,2-Trichloroethane	0.015-1.14	179-13,600	0.179-13.6
Trichloroethene	0.020-1.52	19.6-1,490	19.6-1,490
Total Xylenes	0.18-13.7	2,470,000-188,000,000	2,470,000-188,000,000
BASE NEUTRAL/ACID ORGANICS:			
Bis(2-ethylhexyl)phthalate	50100-3810000	2,460,000,000-187,000,000,000	2,460,000-187,000,000
Di-n-Butyl Phthalate	15.8-1200	10,800,000-824,000,000	10,800,000-824,000,000
Diethyl Phthalate	0.17-12.9	933,000-70,800,000	933,000-70,800,000
Isophorone	0.0025-0.19	417-31,700	0.417-31.7
Naphthalene	0.10-7.6	275,000-20,900,000	275,000-20,900,000
Phenol	0.0029-0.22	796-60,400	796-60,400

(1) Compounds shown are those without a regulatory limit or a soil background level. Also, cyanide is not included because a specific Kow is not available.

(2) For a range of organic carbon content of 0.0001 to 0.0019 obtained from: U.S. Department of Agriculture, Soil Classification - A Comprehensive System. Soil Conservation Service, 7th Approximation, 1960. Calculated as presented in Table B6.

(3) Acceptable soil concentrations at the risk shown (for compounds with potency) for a range of organic carbon content of 0.0001 to 0.0076. Calculated as presented in Table B6.

TABLE B8

REFERENCES

CH2MHILL, Environmental Conservation and Chemical Corporation Feasibility Study, December, 1986.

CH2MHILL, Environmental Conservation and Chemical Corporation Remedial Investigation, March, 1986.

USEPA, Office of Solid Waste and Emergency Response, Memorandum on Interim Final Guidance for Soil Ingestion Rates, January 27, 1989.

USEPA, Region V, Record of Decision for Environmental Conservation and Chemical Corporation, and Northside Sanitary Landfill, Zionsville, Indiana, September 25, 1987.

USEPA, Draft RCRA Facility Investigation Guidance, July, 1987, OSWER Directive 9502.00-6C.

USEPA, National Primary Drinking Water Regulations, 40 CFR 141, last amended by 53 FR 37408, September 26, 1988.

USEPA, Polychlorinated Biphenyls Spill Cleanup Policy Rule, 40 CFR Part 761, published in the Federal Register on April 2, 1987.

USEPA, Superfund Public Health Evaluation Manual, October, 1986, PB87-183125 with updates of November 16, 1987 and July, 1988.

USEPA, Toxics Integration Branch, OERR, Washington, D.C., December, 198 Memorandum with Corrections to the July, 1988 Update of the Risk Characterization Tables in the Superfund Public Health Evaluation Manual.

USEPA, Water-Related Environmental Fate of 129 Priority Pollutants, December, 1979 PB80-204381.

US Geological Survey, Background Geochemistry of Some Rocks, Soils, Plans, and Vegetables in the Conterminous United States, Professional Paper 574-F, 1975.

Veschueren, K., Handbook of Environmental Data on Organic Chemicals, 1983.

APPENDIX C

ECC - VAPOR EXTRACTION MODEL

APPENDIX C

ECC - VAPOR EXTRACTION MODEL

This program was written in FORTRAN by Michael C. Marley and George E. Hoag and reported in "Induced Soil Venting for Recovery/Restoration of Gasoline Hydrocarbons in the Vadose Zone," Proceedings, Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference, Houston, TX, 1984.

The program is based on the concentration of each component in the vapor phase in the soil, using the partial pressure exerted by each compound, as expressed by the following equation:

$$ZT = \frac{VP * X * V * MW}{R * T}$$

where:

ZT = concentration of the component in the vapor phase, mg/l
VP = vapor pressure of compound, mm Hg
X = mole fraction = moles of component/total moles of organics in soil
V = volume of element, liters
MW = molecular weight of component
R = gas constant = 82.4 atm - cm^3/gmoles^{o}K
T = temperature = 294.25^{o}K

The program uses the finite difference method to calculate the change in number of moles of each component during a small time interval (i) and then recalculate over the next time interval (i+1), using the reduced number of moles resulting from subtracting the change in number of moles calculated for interval i from the number of moles present in the soil at the beginning of interval i.

The program runs for a finite length of time or until all the components are removed. The program was rewritten in BASIC and applied to the ECC site.

Table C-1 shows the chemical data used to run the model. The compounds to be evaluated are those shown in Table 3-2, except for EHP, PCBs, and cadmium, which are not amenable to removal by vapor extraction. The maximum detected soil concentrations were taken from Section 4 of the ECC RI, while the vapor pressure and molecular weight data are from USEPA, Superfund Public Health Evaluation Manual, 1986.

As there was significant variation of compounds concentrations between soil samples at the site, a theoretical block size was chosen. This theoretical soil block is 10 ft x 10 ft x 2 ft deep and was assumed to contain all components of interest at their maximum detected concentrations (Table C-1). Furthermore, it was conservatively assumed that the air flow through the soil would only be 15% efficient in removing the organics. In effect, this represents a worst case estimate of the time required to remove the organics from the soils. The mass of this block was estimated as 10,200 kg.

TABLE C1
ECC - CHEMICAL DATA OF COMPOUNDS

Compound (1)	Molecular Weight (2)	Vapor Pressure (2) (mm Hg)	Maximum Detected Soil Concentration (3) (ug/kg)
VOLATILE ORGANICS:			
Acetone	58.1	270	650,000
Chloroform	119	151	2,900
1,1-Dichloroethane	99	182	35,000
1,1-Dichloroethene	97	600	380
Ethylbenzene	106	7	1,500,000
Methylene Chloride	85	362	310,000
Methyl Ethyl Ketone	72.1	77.5	2,800,000
Methyl Isobutyl Ketone	100	6	190,000
Tetrachloroethene	166	17.8	650,000
Toluene	92.1	28.1	2,000,000
1,1,1-Trichloroethane	133	123	1,100,000
1,1,2-Trichloroethane	133	30	550
Trichloroethene	132	57.9	4,800,000
BASE NEUTRAL/ACID ORGANICS:			
Phenol	94.1	0.341	570,000
Isophorone	138	0.38	440,000

(1) Compounds shown are those amenable to soil vapor extraction.
(2) From U.S. EPA, Superfund Public Health Evaluation Manual, 1986.
(3) From ECC RI, March 1986.

The air flow rate was estimated as a fraction of the total air flow rate to be used at the site (500 SCFM), based on the length of injection trench influencing the assumed soil block (10 ft) as a ratio of the total length of injection trenches (3,800 ft). This represents an air flow rate of 37.26 liters per minute.

The results, summarized in Figure C1, show that essentially no VOCs will be present in the hypothetical soil element after 130 days of soil vapor extraction. To remove phenol and isophorone to the Cleanup Standards in Table 3-1, operation of the vapor extraction system for a total of approximately 360 days is necessary.

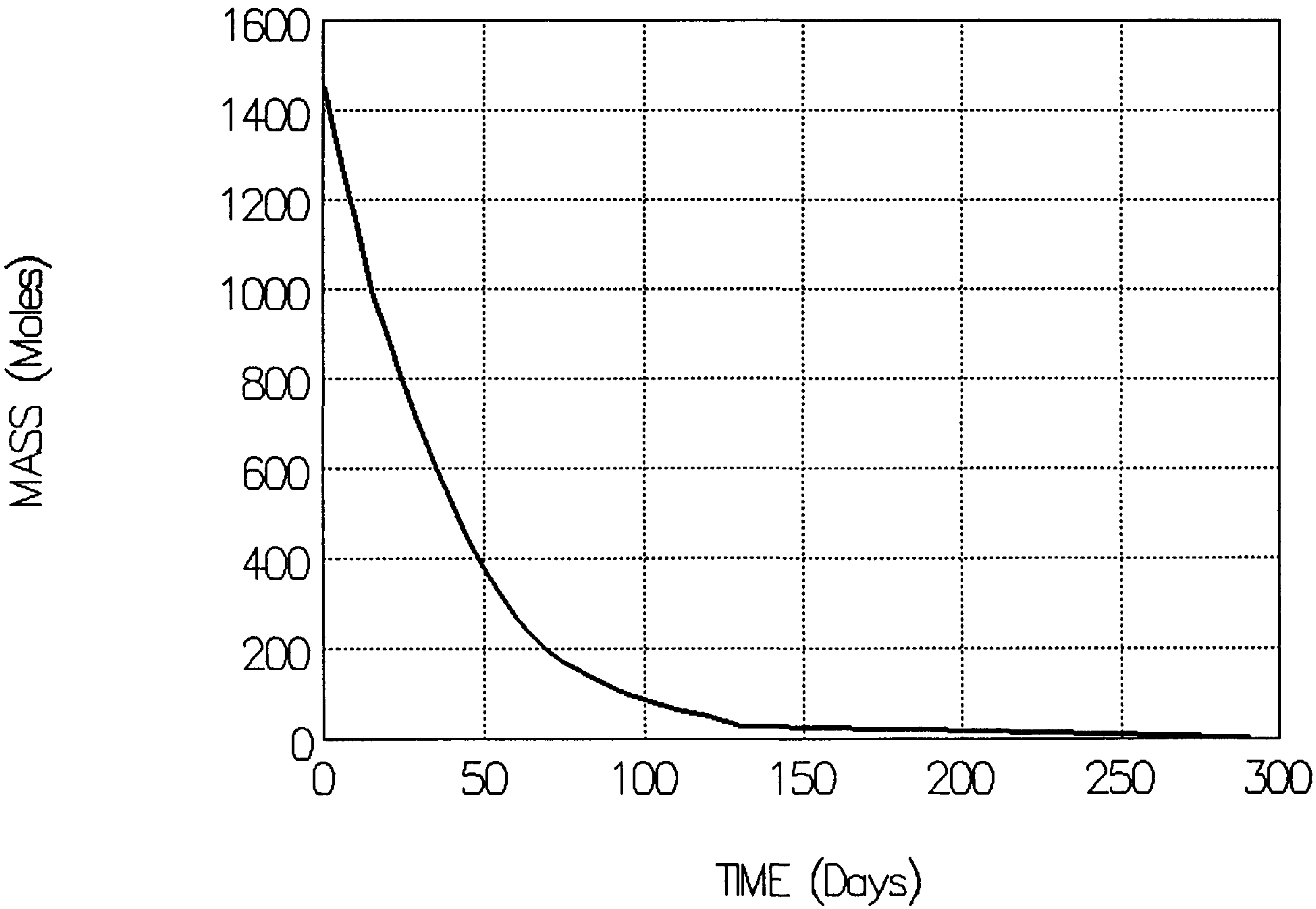
Actual large-scale soil vapor extraction systems have been operated with excellent removals of compounds such as tetrachloroethene, trichloroethene, 1,3-dichloropropene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylenes. Some published references are:

- Lisiecki, J.B., and F.C. Payne. "Enhanced Volatilization: Possibilities, Practicalities, and Performance." Presented at the Engineering Foundation Conference, Mercersburg, PA, August 7-12, 1988.

- Regalbuto, D.P., J.A. Barrera and J.B. Lisiecki. "In-Situ Removal of VOCs by Means of Enhanced Volatilization." Proceedings of the Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, Houston, TX, November 9-11, 1988.

Figure C1

ECC VAPOR EXTRACTION MODEL RESULTS



- Johnson, J.J., and R.J. Sterrett. "Analysis of In-Situ Soil Air Stripping Data." Proceedings of the 5th National Conference on Hazardous Wastes and Hazardous Materials, Las Vegas, Nevada, April 19-21, 1988.

A full-scale vapor extraction system (Lisiecki and Payne, 1988) was able to remove tetrachloroethene from 5,600,000 ug/kg to 17 ug/kg, as found by soil sample analysis, in 280 days. Therefore, both theoretical models and actual results show that the required removals will be accomplished by vapor extraction.

TABLE B3

ECC - ACCEPTABLE HEALTH-BASED GROUND WATER CONCENTRATIONS

Compound (1)	Potency Factor (2) (mg/kg/d)-1	Reference Dose (2) (mg/kg/d)	Acceptable Ground Water Concentration (3) (ug/l)
VOLATILE ORGANICS (VOCs):			
Acetone		0.1	3,500
Chlorobenzene		0.03	1,050
1,1-Dichloroethane	0.091		0.38
Ethylbenzene		0.1	3,500
Methylene Chloride	0.0075		4.7
Methyl Ethyl Ketone		0.05	1,750
Methyl Isobutyl Ketone		0.05	1,750
Tetrachloroethene	0.051		0.69
Toluene		0.3	10,500
1,1,2-Trichloroethane	0.057		0.61
Total Xylenes		2	70,000
BASE NEUTRAL/ACID ORGANICS:			
Bis(2-ethylhexyl)phthalate	0.014		2.5
Di-n-Butyl Phthalate		0.1	3,500
Diethyl Phthalate		0.8	28,000
Isophorone	0.0041		8.5
Naphthalene		0.4	14,000
Phenol		0.04	1,400
INORGANICS:			
Antimony		0.0004	14
Beryllium		0.005	175
Manganese		0.2	7,000
Nickel		0.02	700
Tin		0.6	21,000
Vanadium		0.007	245
Zinc		0.2	7,000
Cyanide		0.02	700

(1) Only compounds without a regulatory limit (drinking water Maximum Contaminant Level [40 CFR 141] or PCBs Spill Cleanup Policy Rule [40 CFR 761] level) are shown.

(2) From USEPA Toxics Integration Branch, OERR, Washington, D.C. December 1988 correction to the July 1988 Update of the Risk Characterization Tables in the Superfund Public Health Evaluation Manual.

(3) Acceptable ground water concentrations calculated using an ingestion rate of 2 liters per day by a 70 kg adult for 70 years. Acceptable risk = 1E-06 for compounds with potency and 1 for compounds with reference dose.

TABLE B4

COMPARISON OF SITE-SPECIFIC STREAM CRITERIA
WITH STREAM CONCENTRATIONS BASED ON NATURAL
DISCHARGE OF GROUND WATER FROM THE TILL

Compounds (1)	Acceptable Stream Concentration (1) (ug/l)	Concentration at Unnamed Ditch due to Discharge of Till Water at Acceptable Concentrations (2) (ug/l)
VOLATILE ORGANICS (VOCs):		
Chloroform	15.7	0.056
1,1-Dichloroethene	1.85	0.0039
Ethylbenzene	3,280	1.9
Methylene Chloride	15.7	0.0026
Tetrachloroethene	8.85	0.00038
Toluene	3,400	5.8
1,1,1-Trichloroethane	5,280	0.11
1,1,2-Trichloroethane	41.8	0.00034
Trichloroethene	80.7	0.0028
BASE NEUTRAL/ACID ORGANICS:		
Bis(2-ethylhexyl)phthalate	50,000	0.0014
Di-n-Butyl Phthalate	154,000	1.9
Diethyl Phthalate	52,100	15.6
Naphthalene	620	7.8
Phenol	570	0.78
INORGANICS:		
Arsenic	0.0175	0.028
Chromium	11	0.028
Lead	10	0.028
Nickel	100	0.39
Zinc	47	3.9
Cyanide	5.2	0.39

(1) From Table 1 of the Record of Decision (ROD) for the site, September 25, 1987. Only those compounds detected in ECC soil samples that are listed in this table are shown.

(2) Assuming a dilution of 1:1800 for natural discharge of till ground water at acceptable concentrations into Unnamed Ditch (from ECC Remedial Investigation, Appendix C).

TABLE B5

ECC - ACCEPTABLE SOIL CONCENTRATIONS BASED ON SOIL INGESTION

Compounds (1)	Potency Factor (2) (mg/kg/d)-1	Reference Dose (2) (mg/kg/d)	Acceptable Soil Concentrations (3) (ug/kg)	Range of Acceptable Soil Concentrations (4) (ug/kg)
VOLATILE ORGANICS (VOCs):				
Acetone		0.1	8,500,000	850,000-850,000,000
Chlorobenzene		0.03	2,550,000	255,000-255,000,000
Chloroform	0.0061		114,754	11,475-11,475,400
1,1-Dichloroethane	0.091		7,692	769-769,200
1,1-Dichloroethene	0.6		1,167	117-116,700
Ethylbenzene		0.1	8,500,000	850,000-850,000,000
Methylene Chloride	0.0075		93,333	9,333-9,333,300
Methyl Ethyl Ketone		0.05	4,250,000	425,000-425,000,000
Methyl Isobutyl Ketone		0.05	4,250,000	425,000-425,000,000
Tetrachloroethene	0.051		13,725	1,373-1,372,500
Toluene		0.3	25,500,000	2,550,000-2,550,000,000
1,1,1-Trichloroethane		0.09	7,650,000	765,000-765,000,000
1,1,2-Trichloroethane	0.057		12,281	1,228-1,228,100
Trichloroethene	0.011		63,636	6,364-6,363,600
Total Xylenes		2	170,000,000	17,000,000-17,000,000,000
BASE NEUTRAL/ACID ORGANICS:				
Bis(2-ethylhexyl)phthalate	0.014		50,000	5,000-5,000,000
Di-n-Butyl Phthalate		0.1	8,500,000	850,000-850,000,000
Diethyl Phthalate		0.8	68,000,000	6,800,000-6,800,000,000
Isophorone	0.0041		170,732	17,073-17,073,200
Naphthalene		0.4	34,000,000	3,400,000-3,400,000,000
Phenol		0.04	3,400,000	340,000-340,000,000
INORGANICS:				
Cyanide		0.02	1,700,000	170,000-170,000,000

(1) Compounds shown are those without a regulatory limit or background level in soils.

(2) From USEPA Toxics Integration Branch, OERR, Washington, D.C. December 19, 1988 corrections to the July 1988 Update of the Characterization Tables in the Superfund Public Health Evaluation Manual.

(3) Intake for compounds with potency: 0.1 g of soil/d by 70 kg resident adults.
Intake for compounds with reference dose: 0.2 g of soil/d by 17 kg resident children.
Acceptable risks: 1E-06 for compounds with potency; 1 for compounds with reference doses.

(4) Range shown is for risks of 10-4 to 10-7 for compounds with potency and 1 for compounds with reference doses.

TABLE,B6 (Page 1 of 2)

ECC - ACCEPTABLE SOIL CONCENTRATIONS BASED ON GROUND WATER INGESTION AT THE SITE (10-6 RISK)

Compound (1)	Solubility (2) (ug/l)	Log Kow (2)	Kd (3)	Acceptable Ground Water Concentration (4) (ug/l)		Acceptable Leachate Concentration (5) (ug/l)	Acceptable Soil Concentration (6) (ug/kg)
VOLATILE ORGANICS (VOCs):							
Acetone	1,000,000,000	-0.24	0.00071	3,500	RB	686,275	490
Chlorobenzene	466,000	2.84	0.858	1,050	RB	205,882	176,620
Chloroform	8,200,000	1.97	0.116	100	MCL	19,608	2,269
1,1-Dichloroethane	5,500,000	1.79	0.076	0.38	RB	74.5	5.70
1,1-Dichloroethene	2,250,000	1.84	0.086	7	MCL	1,373	118
Ethylbenzene	152,000	3.15	1.75	3,500	RB	686,275	1,202,042
Methylene Chloride	20,000,000	1.25	0.022	4.7	RB	922	20.3
Methyl Ethyl Ketone	268,000,000	0.26	0.00226	1,750	RB	343,137	774
Methyl Isobutyl Ketone	17,000,000		0.02604	1,750	RB	343,137	8,935
Tetrachloroethene	200,000	2.88	0.941	0.69	RB	135	127
Toluene	535,000	2.69	0.607	10,500	RB	2,058,824	1,250,377
1,1,1-Trichloroethane	4,400,000	2.17	0.183	200	MCL	39,216	7,193
1,1,2-Trichloroethane	4,500,000	2.17	0.183	0.61	RB	120	21.9
Trichloroethene	1,100,000	2.29	0.242	5	MCL	980	237
Total Xylenes	198,000	3.26	2.26	70,000	RB	13,725,490	30,970,595
BASE NEUTRAL/ACID ORGANICS:							
Bis(2-ethylhexyl)phthalate	1,300	8.7	621472	2.5	RB	490	304,643,220
Di-n-Butyl Phthalate	13,000	5.2	197	3,500	RB	686,275	134,871,303
Diethyl Phthalate	4,320,000	3.22	2.06	28,000	RB	5,490,196	11,298,207
Isophorone	12,000		0.031	8.5	RB	1,667	51.7
Naphthalene	30,000	3.01	1.269	14,000	RB	2,745,098	3,483,209
Phenol	93,000,000	1.46	0.036	1,400	RB	274,510	9,817

TABLE B6 (Page 2 of 2)

(1) Compounds shown are those without a regulatory limit or a soil background level. Also, cyanide is not included because a specific Kow is not available.

(2) From ECC RI, Table 4-4, and Verschueren, 1983, Handbook of Environmental Data on Organic Chemicals.

(3) From ECC RI, Table 4-4. Calculated as 10^log Kow * OC, where OC= organic carbon content = 0.00124. For isophorone and methyl isobutyl ketone, the Kd is obtained as Kd = Koc * OC, where Koc = organic carbon-water partition coefficient, obtained from log Koc = (-0.55 * log S) + 3.64 (Exhibit A-1 of the Superfund Public Health Evaluation Manual, 1986).

(4) RB = risk-based concentration, from Table B3. MCL = Maximum Contaminant Level, from Superfund Public Health Evaluation Manual, update of November, 1987.

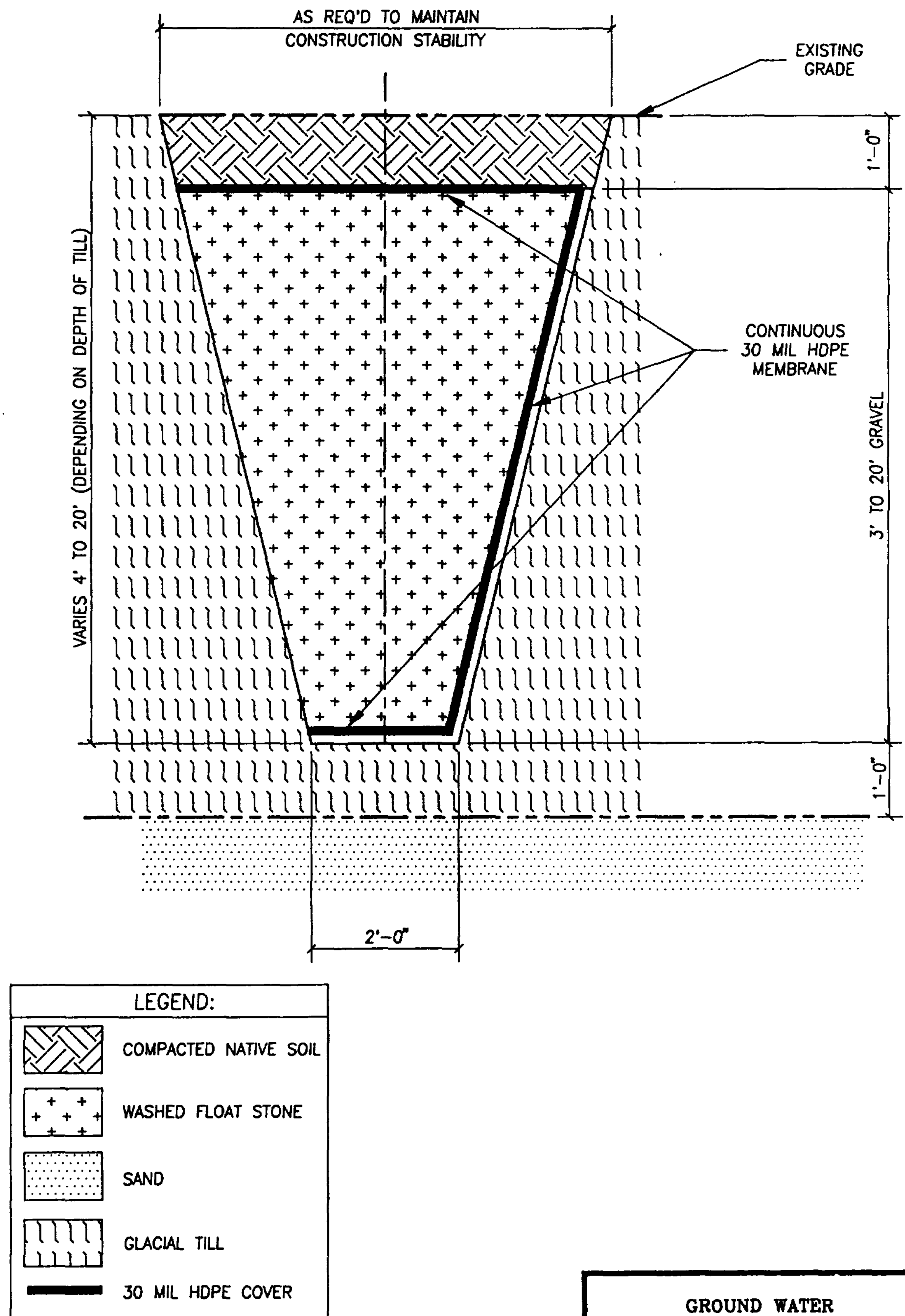
(5) Leachate discharge/ground water discharge = 0.0051 (Appendix C of the ECC RI; and reduction of the 7.8 in/yr recharge used in the RI under the current conditions (page 5-8) by 99 percent due to the cap).

(6) Soil concentration (ug/kg) = Kd * Concentration in leachate (ug/l).

assumed that the volume of leachate from the soils will be reduced by 99 percent from the 7.8 in/yr used in the RI, by installing the RCRA-compliant cover over the site.

A range of acceptable soil concentrations based on water ingestion using the published ranges for organic carbon content of till soils and the SARA range of risk for Superfund site cleanups, is presented in Table B7. The concentrations shown in Table B6 were used to determine the Cleanup Standards specified in Table 3-1, using a risk of 10^{-6} and a soil organic carbon content of 0.12%, as presented in the RI.

Finally, Table B8 presents the complete list of references used for the calculation of the proposed Cleanup Standards specified in Table 3-1.



GROUND WATER INTERCEPTION TRENCH CROSS-SECTION	FIGURE 3-2
ERM ERM-North Central, Inc.	3/1/89 cs

Nothing in this Section 3.7 shall prevent the Settling Defendants from undertaking additional work under this section before the expiration of the 5 year period should it become evident that the vapor extraction system will not achieve the Cleanup Standards in Table 3-1.

4.0 REMEDIAL ACTION COMPLIANCE MONITORING

Remedial action compliance monitoring within the site (i.e., attainment of soil concentrations specified in Table 3-1) is presented below.

Enhanced volatilization of compounds is designed to achieve the required removals of VOCs, phenol and isophorone as presented in Appendix C. The time required to accomplish this removal depends on the type of compound and soil, air flow rate and temperature, and on an efficient diffusion of air through the soil pores. Therefore, both estimation of the time required for treatment using vapor extraction models (Appendix C) and surrogate analyses, as shown herein, will be used to determine the duration of vapor extraction operation.

The two surrogate analyses to be used to verify that acceptable soil concentrations have been reached are extracted vapor analysis and on-site till water analysis. The only media that come into contact with the on-site soils are air and water. Sampling the extracted air and till water provides an accurate, efficient and effective method of assaying what concentrations are left in the soil. An additional benefit is that these methods can be accomplished while preserving the integrity of the RCRA- compliant cover to be placed on the site. As the only media that come in contact with the soil will meet the Table 3-1 soil Cleanup Standards, then any concentrations that theoretically could remain in the soil: (1) are not capable of migrating; (2) cannot, by definition, result in a hazard to the air or ground water; and (3) are effectively isolated from contact and exposure by the cover.

4.1 Vapor Extraction Model

A computer model which simulates the vapor extraction system was used to estimate the time required for removal of the maximum detected soil concentrations to acceptable soil cleanup standards specified in Table 3-1. Appendix C summarizes the characteristics of the model and the data used. The air flow rate was proportionately reduced from the total flow of 500 SCFM, using the ratio of length of element to total length of trench, and conservatively assuming an efficiency ratio for the operation of 15 percent. Based on the model results, it is expected that after one year of operation, all the VOCs, as well as phenol and isophorone, will be below the soil Cleanup Standards in Table 3-1 in a "worst case" soil element which contains all the compounds at their maximum detected concentrations.

4.2 Extracted Vapor Analysis

The vapor extraction system will be capable of providing vapor samples from each individual extraction trench as well as from the combined air flow.

The combined air flow will be sampled daily during the first week of operation, weekly for the following 4 weeks, and monthly thereafter. Samples will be analyzed for the VOCs of concern

(Table 3-1), phenol and isophorone. Also, air flow rate will be monitored and recorded, to provide sufficient data to calculate the mass of organics removed from the soils and the effectiveness of the system. These data will also aid in estimating the treatment time remaining, based on the organics mass rate extracted per day.

Air samples from individual extraction trenches will be collected at the beginning of the vapor extraction system operation to establish a baseline of organics removal per trench. These samples will be analyzed for the VOCs of concern (Table 3-1), phenol and isophorone. Once the mass rate extracted per day is reduced to 5 percent of the initial week's rate, additional samples of individual trenches will be collected every three months, to determine when individual extraction trenches can be shut down. The criterion for shutting down individual trenches will be that two consecutive air samples from an individual trench show vapor concentrations to be in equilibrium with the soil Cleanup Standards in Table 3-1.

4.3 Till Water Analysis

Till water within the zone of soil vapor extraction treatment will be collected from four monitoring wells completed in the till. The wells will be 2-in. PVC and will be screened from one foot above trenches bottom to 1-2 feet above the contact between the till and underlying sand and gravel. Screens will have 0.01 inch openings. The wells will have a sand pack to one foot above the top of the screen and a bentonite grout to ground surface.

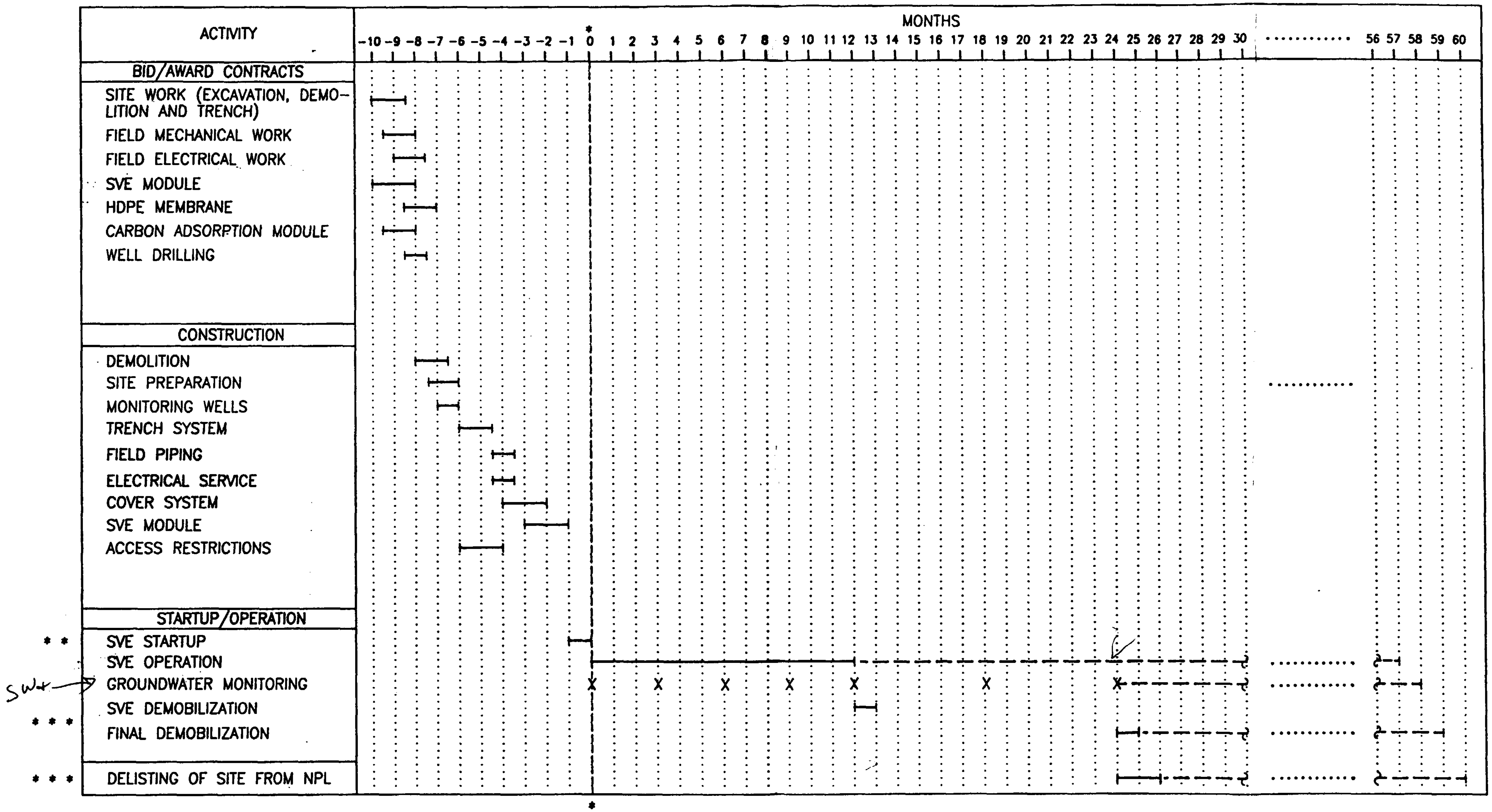
Samples of the till water will be collected at the beginning of the soil vapor extraction operation, and every three months thereafter. Every time till water is to be collected, the vapor extraction system will be shut down, to allow water to stabilize within the till. Samples will be collected and analyzed for the VOCs of concern (Table 3-1), phenol and isophorone. These results will then be used to calculate soil concentrations (as presented in Appendix B, Table B6). During construction of these monitoring wells, soil samples will be collected from 1 to 9 feet below the existing surface at 2-foot intervals and analyzed for organic carbon content to provide site specific verification of design calculations.

5.0 MISCELLANEOUS PROVISIONS AND SCHEDULING

Attached to this Exhibit A as Appendices D, E, and F are the Health and Safety Plan, the Quality Assurance Project Plan, and the Field Sampling Plan, respectively, which provide additional details on how the work described in earlier sections of this Document will be accomplished.

Additional future activities will consist of preparing a document package for EPA and State review that will include appropriate construction contract specifications to facilitate competitive bidding by potential contractors. This document package will be submitted to EPA and the State within six (6) months of the entry of the Decree and prior to the construction of the NSL pipeline.

Figure 5-1 sets forth the Remedial Action Implementation Schedule for implementing the remedy required under the Consent Decree.



NOTES:

SVE ≙ SOIL VAPOR EXTRACTION

* ~~MONTH "0" CORRESPONDS TO THE DATE THE NSL PIPLINE IS AVAILABLE FOR ECC USE~~

** ~~SVE SYSTEM~~ OPERATION IS PLANNED FOR 12 MOS. BUT MAY BE EXTENDED IF NECESSARY TO ACHIEVE CLEANUP STANDARDS

*** FINAL DEMOBILIZATION AND DELISTING ACTIVITIES WILL OCCUR ONCE CLEANUP STANDARDS HAVE BEEN ACHIEVED & VERIFIED.

REMEDIAL ACTION IMPLEMENTATION SCHEDULE	FIGURE NO. 5-1
ERM ERM–North Central, Inc.	3/1/89 mo

APPENDIX A

ESTIMATE OF MASS OF ORGANICS IN THE SOILS TO BE REMOVED BY VAPOR EXTRACTION

APPENDIX A
ESTIMATE OF MASS OF ORGANICS IN THE SOILS TO BE REMOVED BY VAPOR EXTRACTION

Location	Sampling depth ft	Assumed contamination depth, ft	Total VOCs concentration ug/kg	Mass of VOCs lb
TP-1	1 - 1.5	2	1,972	0.271
TP-2	1 - 1.5	2	28	0.004
TP-3	1 - 1.5	2	108,800	14.978
TP-4	1 - 2	2.5	99,730	17.162
TP-4	2.5 - 3.5	4	4,416	1.216
TP-5	1 - 2	2	24,287	3.343
TP-5	2 - 3	1.5	291	0.030
TP-6	1 - 2	2	12,468,000	1,716.410
TP-6	2 - 3	1.5	22,690	2.343
TP-6	4 - 5	1.5	2,416	0.249
TP-7	1 - 2.5	2.5	267,000	45.946
TP-7	2.5 - 4	2	280,090	38.559
TP-8	1 - 2.5	2.5	3,687	0.634
TP-8	2.5 - 4	2	433,600	59.692
TP-9	1 - 3	3	14,604,000	3,015.694
TP-9	3 - 5	2.5	130	0.022
TP-10	1 - 3	3	958	0.198
TP-10	3 - 5	2.5	432	0.074
TP-11	1 - 3	3	130	0.027
TP-11	3 - 5	2.5	67	0.012
TP-12	1 - 3	3	35,030	7.234
TP-12	3 - 5	2.5	3,609	0.621
SB-01	2.5 - 4	3	3,303	0.682
SB-02	2.5 - 4	3	12,900	2.664
SB-03	2.5 - 4	3	70,070	14.469
SB-04	2 - 3.5	2.5	175	0.030
SB-06	2 - 3.5	2.5	222,010	38.204
SB-08	2.5 - 4	3	3,012	0.622
SB-09	2.5 - 4	3	61,490	12.698
SB-01	5.5 - 7	2	27	0.004
SB-02	5.5 - 7	2	34	0.005
SB-04	5 - 6.5	2	51	0.007
SB-08	7 - 8.5	2	188	0.026
SB-09	5.7 - 7	2	8,069	1.111
			TOTAL VOCs, lb	4,995

* The area contaminated is assumed to be a 25'x25' square around each sampling location. TP = test pit; SB = soil boring. Soil concentrations from ECC RI, Section 4.

APPENDIX B

CALCULATION OF RISK-BASED CLEANUP STANDARDS

APPENDIX B

CALCULATION OF RISK-BASED CLEANUP STANDARDS

The equations used to calculate risk-based concentrations are shown in Table B1. The ingestion rates and acceptable risks are listed in Table B2. The potency factors and references doses for compounds without any regulatory or background level are from a memorandum from the USEPA Toxics Integration Branch, OERR, Washington, D.C., dated December 19, 1988, with the Corrections to the July, 1988 Update of the Characterization Tables in the Superfund Public Health Evaluation Manual.

Table B3 presents the calculation of risk-based acceptable ground water concentrations in the till for compounds without a regulatory limit (drinking water Maximum Contaminant Level or PCBs Spill Cleanup Policy level). Table B4 shows that the resulting concentrations of compounds at Unnamed Ditch will be below the Stream Criteria presented in Table 1 of the Record of Decision (ROD) for the site, dated September 25, 1987. The dilution obtained from discharge of the ground water in the till to Unnamed Ditch is 1:1800, as presented in Appendix C of the ECC Remedial Investigation. Note that most of the calculated concentrations in the ditch are below detection limits.

Tables B5 and B6 list the acceptable risk-based soil concentrations, based on soil and ground water ingestion, respectively. The calculation of acceptable soil concentrations based on ground water ingestion follows the procedures presented in Appendix C of the ECC RI. Only those compounds without regulatory limit or background levels in soils are listed in Tables B5 and B6. Also, cyanide is not present for lack of a organic carbon/water partition coefficient. It is conservatively

TABLE B1

EQUATIONS USED TO CALCULATE RISK-BASED CONCENTRATIONS *

SOIL (concentrations in ug/kg):

$$\frac{\text{Risk} * \text{Body Weight (kg)} * 1000\ \text{(ug/mg)} * 1000\ \text{(g/kg)}}{\text{Ingestion rate (g/d)} * \text{Potency Factor (mg/kg/d)-1}}$$

or

$$\frac{\text{Risk} * \text{Body Weight (kg)} * \text{Reference Dose (mg/kg/d)} * 1000\ \text{(ug/mg)} * 1000\ \text{(g/kg)}}{\text{Ingestion rate (g/d)}}$$

GROUND WATER (concentrations in ug/l):

$$\frac{\text{Risk} * \text{Body Weight (kg)} * 1000\ \text{(ug/mg)}}{\text{Ingestion rate (l/d)} * \text{Potency Factor (mg/kg/d)-1}}$$

or

$$\frac{\text{Risk} * \text{Body Weight (kg)} * \text{Reference Dose (mg/kg/d)} * 1000\ \text{(ug/mg)}}{\text{Ingestion rate (l/d)}}$$

TABLE B2
INGESTION RATES AND ACCEPTABLE RISKS

INGESTION RATES * :

SOILS:

0.1 grams per day by a 70-kilogram person for 70 years

or

0.2 grams per day by a 17-kilogram child for 5 years

GROUND WATER:

2 liters of water per day by a 70-kilogram person for 70 years

ACCEPTABLE RISKS:

COMPOUNDS WITH POTENCY FACTORS:

10^{-6}

COMPOUNDS WITH REFERENCE DOSES:

1

* From U.S. EPA, RCRA Facility Investigation Guidance, 1987, and U.S. EPA, Office of Solid Waste and Emergency Response, Memorandum on Interim Final Guidance for Soil Ingestion Rates, January 27, 1989.